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Chronic Dislocation of the 5th Metatarsophalangeal Joint with Physeal Injury of Metatarsal: A Case Report

By Manorma Singh, Sanjeev Sharma, Suman Sharma & Rahul Sharma

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Abstract- Metatarsophalangeal joint dislocations are uncommon injuries. This article describes the surgical management of such injury with six months follow up report. A 13 years old boy presented with the complaints of deformity and shortening of the 5th toe of the right foot with callosity on plantar aspect since last five years. He sustained this injury by hitting a stone. He was diagnosed to have a compound dislocation of a metatarsophalangeal joint with severely angulated Salter and Harris type II epiphyseal injury of 5th toe of the left foot. Joint dislocation caused deformed shortened 5th toe, and epiphyseal malunion resulted in the plantar bony projection, callosity, ulceration, difficulty in walking and wearing the footwear. This case was managed surgically that culminated in an optimum functional and structural outcome. Malunited epiphysis was excised, the metatarsal bone was aligned and fixed with proximal phalanx by Kirschner wire to establish a pseudarthrosis. This method can be useful in such cases; however, needs to be evaluated with future studies.

Keywords: metatarsophalangeal joint, chronic dislocation, epiphyseal injury, pseudarthrosis.

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Chronic Dislocation of the 5th Metatarsophalangeal Joint with Physeal Injury of Metatarsal: A Case Report

Manorma Singh [α], Sanjeev Sharma [σ], Suman Sharma [ρ] & Rahul Sharma [ω]

Abstract- Metatarsophalangeal joint dislocations are uncommon injuries. This article describes the surgical management of such injury with six months follow up report. A 13 years old boy presented with the complaints of deformity and shortening of the 5th toe of the right foot with callosity on plantar aspect since last five years. He sustained this injury by hitting a stone. He was diagnosed to have a compound dislocation of a metatarsophalangeal joint with severely angulated Salter and Harris type II epiphyseal injury of 5th toe of the left foot. Joint dislocation caused deformed shortened 5th toe, and epiphyseal malunion resulted in the plantar bony projection, callosity, ulceration, difficulty in walking and wearing the footwear. This case was managed surgically that culminated in an optimum functional and structural outcome. Malunited epiphysis was excised, the metatarsal bone was aligned and fixed with proximal phalanx by Kirschner wire to establish a pseudarthrosis. This method can be useful in such cases; however, needs to be evaluated with future studies.

Keywords: metatarsophalangeal joint, chronic dislocation, epiphyseal injury, pseudarthrosis.

I. Introduction

Metatarsophalangeal (MTP) joints of the foot aresmall, very stable; and rarely get dislocated[1,2]. Dislocations are usually dorsal in direction, but horizontaland plantar dislocations have also been reported[3]. Epiphyseal injuries are the fractures through the growth plates of the bones of the children. Management of such injuries (mal-united fractures and chronic dislocations) is surgical. The present case report describes the management of an ignored dislocation of 5thmetatarso-phalangeal joint with marked ventrally displaced epiphyseal (Salter–Harris type II) injury of head of 5th metatarsal. The report emphasizes the importance of careful physical examination and assessment of the morbid anatomy of the injury by radiographs; followed by proper management.

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II. Case History

a) Personal Profile and Present History of the Patient

The patient was 13 years old male, student of 6th standard, belonging to middle socio-economic status and Hindu religion. The patient was presented in the hospital with the history of trauma right foot 5 years back having the complaints of deformity and shortening of the 5th toe of right foot with callosity on plantar aspect for last five years. He sustained this injury by accidentally hitting a stone while he was taking a bath outdoors resulting in a wound on the dorsum of foot and injury to joint and bone.

b) Treatment History

He was treated in a private clinic (general practitioner) by wound closure that healed in due course of time, but skeletal injury remained ignored. All this resulted in deformity with displaced epiphysis projecting ventrally and base of dislocated proximal phalanx protruding dorsally. Toe as a whole became short, dorsiflexed and made the footwear bearing and walking difficult. Continuous friction over the ventrally projected displaced epiphysis resulted in a painful callosity and ulceration.

III. Clinical Examination

Clinically there was deformity and shortening of 5th toe right foot with scar mark of wound closure dorsally [Figure 1(a)]. On the planter side there was visible protuberance with callosity and ulceration [Figures 1(b) & 1(c)]. On palpation, the plantar protuberance was bony hard. Dorsally the base of the proximal phalanx was palpable. There was minimal tenderness, stiffness, and loss of active and passive movements.

IV. Investigations

Antero-Posterior and lateral views of X-rays of both the feet were taken and compared. All the required blood investigations along with chest X-ray were done, and were found within normal limits.

V. Diagnosis

Based on the history, clinical findings and radiographic investigation, it was diagnosed as chronic

metatarsophalangeal joint dislocation with plantarangulation of malunited Salter and Harris type II epiphyseal injury of head of 5th metatarsal [Figure 2].

VI. Management

a) Planning

Main complaints of the patient were an inability to wear the shoes, difficulty in walking and visible deformity. Conservative reduction was not possible due to fibrosis and malunion of epiphyseal injury owing to a long duration of the injury. So correction by open reduction and internal fixation was planned.

b) Anesthesia and Tourniquet

Procedure was done under the spinal anesthesia. Tourniquet at mid-thigh level was used, and all the precautions were followed.

c) Incision and approach

Injury was approached by dorsal and ventral (plantar) two different approaches. Ventrally 2cm straight incision directly over the prominence and on dorsal aspect a zigzag 3cm long incision was made. Angulated mal-united epiphysis was just beneath the skin and could be approached directly. Dorsally joint was approached by the Z-tenotomy of extensor tendon that was short and tense.

d) Procedure

Excision of callosity and displaced distal epiphysis of the head of5th metatarsal was done. The rough raw area made smooth by bone file. Dorsally after Z-tenotomy of extensor tendon dislocated base of phalanx exposed and mobilized by excising the fibrous tissue. It was aligned with the metatarsal bone and fixed with 1.2mm Kirschner wire [Figure 3 (a)]. After that, lengthening of the extensor tend on was done by performing Z-tenoplasty. Both the wounds were closed [Figures 3 (a), 3 (b) & 3 (c)].

e) Immobilization

Below knee Plaster of Paris (POP) slab was applied [Figure 4]. The post-operative period was uneventful and Kirschner wire was kept in situ for three weeks. Patient was discharged after suture removal [Figures 7(a) & 7(b)].

f) Follow up

On follow up after three weeks K-wire and below knee Plaster of Paris slab were removed [Figure 8].There was no deformity except slight shortening of 5th toe.

VII. Result

The patient was allowed full weight-bearing at the end of one month. He was able to wear the shoes and walk freely after one month of surgery. After six months follow up, the patient was able to walk comfortably with or without shoes but slight dorsal drifting of the 5th toe with shortening was there. No recurrence of callosity was there and painless movements at metatarsophalangeal pseudarthrosis were present.

VIII. Discussion

Foot injuries if ignored or not properly treated can affect the ability to use the foot and lower extremity and can lead to significant long term problems of stiffness, post-traumatic arthritis, pain, instability, callosities, difficulty in footwear wearing and walking. It is necessary to evaluate these injuries properly and plan treatment accordingly. The present case was of an ignored dislocation of 5th metatarsophalangeal joint with Salter and Harris type II epiphyseal injury of the capital epiphysis of 5th meta-tarsal with marked angulation with planter displacement and mal-union. He was also having painful plantar callosity beneath the projecting displaced epiphysis. Open reduction is best accomplished through a dorsal approach[4-10]. Temporary K-wire fixation is only indicated when the reduced joint is very unstable. This case was operated by the authors, five years after sustaining the injury. Capital epiphysis and callosity were excised by direct plantar approach, whereas metacarpal and proximal phalanx were aligned and fixed by K wire for three weeks. A pseudarthrosis developed in between the metaphysis of metacarpal and proximal phalanx with useful movements. Contraction of dorsal surgical wound resulted in slight contracture carrying the toe bit dorsally. As the bony spur was removed, so callosity did not re-appeared and shortening of the toe after surgery was the result of excision of metatarsal head.

IX. Conclusion

Traumatic dislocation of the metatarsophalangeal joint and epiphyseal injuries of small joints of foot and toes should be attended, diagnosed, and adequate treatment should be employed early to avoid complications. The case of chronic metatarsophalangeal joint dislocations with or without epiphyseal injuries should be treated surgically by appropriate surgical approaches. This unusual chronic metatarsophalangeal joint dislocation with epiphyseal injury was well managed by surgery with the good functional and structural outcome. This method can be useful in such cases, however, needs to be evaluated with future studies.

Declaration of Patient Consent: The authors certify that they have obtained the consent of the patient and his parents for the clinical history and images to be reported in the journal while maintaining confidentiality.

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Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

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Figure 1

Figure 2

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Arthroscopic Excision of Calcification in Lateral Collateral Ligament of the Knee with Direct Lateral (Bengaluru Chandrashekar) Portal

By Chandrashekar Puttaswamy, Nataraj Honnavalli Mallappa, Nagaraja Handenahally & Srinivasula Reddy Avula

Introduction- Calcium apatite deposition disease (CADD) is a common entity characterized by deposition of calcium apatite crystals within and around connective tissues, usually in a periarticular location[1]. Many different locations of CADD have been described amongst which, lateral collateral ligament (LCL) of the knee is a rare location[2]. The first ever case of calcific deposits in the lateral collateral ligament of the knee was reported by Anderson et al[3] in 2003. A few isolated case reports of LCL calcification are published in the literature [4,5] but arthroscopic excision of calcific deposit in LCL has not been described yet in the literature. Here we are describing 2 cases of arthroscopic excision of calcific deposits in LCL of the knee by a new portal called 'Direct lateral portal' for the knee.

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Arthroscopic Excision of Calcification in Lateral Collateral Ligament of the Knee with Direct Lateral (Bengaluru Chandrashekar) Portal

Chandrashekar Puttaswamy [α], Nataraj Honnavalli Mallappa [σ], Nagaraja Handenahally [ρ] & Srinivasula Reddy Avula [ω]

I. Introduction

Calcium apatite deposition disease (CADD) is a common entity characterized by deposition of calcium apatite crystals within and around connective tissues, usually in a periarticular location[1]. Many different locations of CADD have been described amongst which, lateral collateral ligament (LCL) of the knee is a rare location[2]. The first ever case of calcific deposits in the lateral collateral ligament of the knee was reported by Anderson et al[3] in 2003. A few isolated case reports of LCL calcification are published in the literature [4,5] but arthroscopic excision of calcific deposit in LCL has not been described yet in the literature. Here we are describing 2 cases of arthroscopic excision of calcific deposits in LCL of the knee by a new portal called 'Direct lateral portal' for the knee.

II. Case Report

Both cases were operated after institutional ethical committee clearance. The 2 cases reported here were operated using the New "Direct Lateral Portal/Bengaluru Chandrashekar Portal" after obtaining written informed consent with a prior explanation of the procedure.

Case 1- A 50-year-old lady presented with pain in the left knee of one year duration. There was no improvement with conservative treatment in the form of anti-inflammatory medication and physiotherapy. X-ray of the knee showed calcification in the LCL region (Fig. 1a 1b).

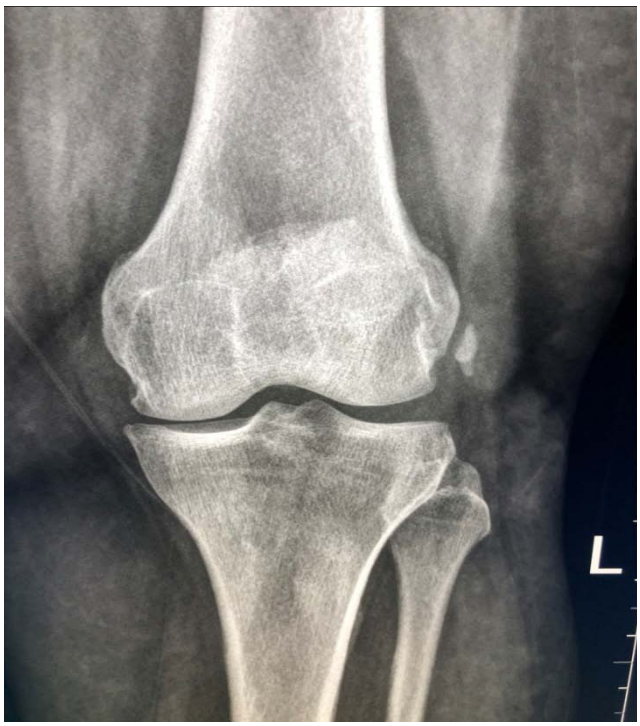

Figure 1a: Calcification in LCL Region

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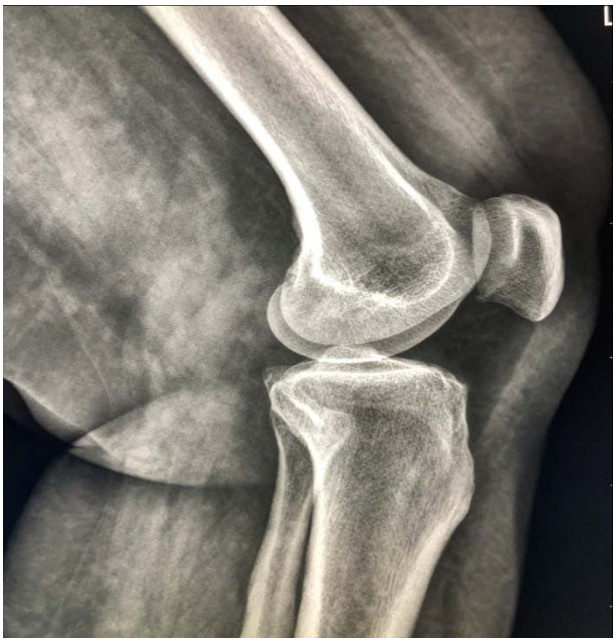

Figure 1b: Calcification in LCL Region

Fig. 1a and 1b: X-ray AP and Lateral views showing calcific deposits over lateral condyle

MRI scan showed intra-substance calcification in the LCL near the femoral attachment and associated medial meniscus root tear (Fig. 2a, 2b). With no improvements with medications and conservative method of treatment for 1 year, the patient opted for our treatment plan of arthroscopic meniscal root repair with concomitant arthroscopic excision of LCL calcification.

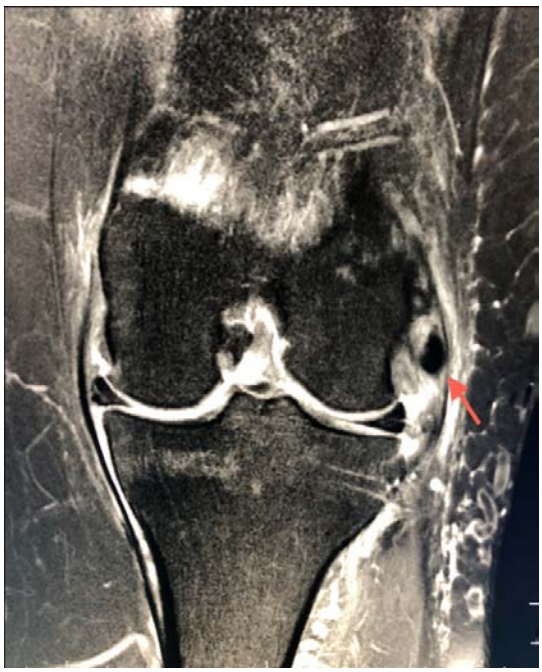

Figure 2a: Calcification near Femoral Attachment

Figure 2b: Medial Meniscus Root Tear

Fig. 2a and 2b: MRI images showing calcific deposits in LCL and medial meniscus root tear (Arrows)

Case 2- A 54-year-old lady presented with left knee pain of 6 months duration. She was treated with anti-inflammatory medications and physiotherapy. But the symptoms showed no improvement. X-ray showed calcific deposits in the lateral side of the knee. MRI showed calcific deposits at the femoral attachment of LCL. Since her pain interfered with daily activities, arthroscopic excision of calcific deposits was considered.

The technique of arthroscopic excision of calcification in LCL.

Under spinal anesthesia, the patient is placed in supine position with the limb held by thigh holder, so that the knee is in a hanging down position, making a flexion angle of 90 degrees. Standard anterolateral and anteromedial portals were made. The knee was then positioned into extension with arthroscope in the anterolateral portal. A needle was placed over lateral epicondyle under IITV guidance (Fig. 3). With the arthroscope in the anterolateral portal, the superolateral portal was made. Bands over the lateral gutter (Fig. 4 a) were cleared and then the arthroscope was moved inferiorly and posteriorly until the needle over the lateral epicondyle (Fig. 4 b) was visualized. A direct lateral portal, 1cm inferior and 1cm posterior to the lateral epicondyle with the knee in extension was made (Fig. 4 c and d). The calcific deposits in LCL were visualized (Fig. 4 e).

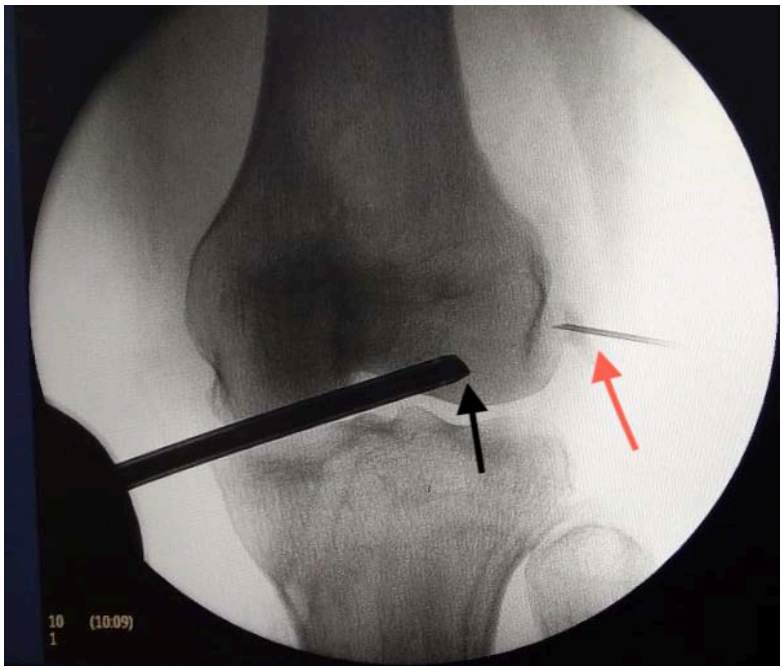

Figure 3: Lateral Epiconcdyle Needle

Fig. 3: Needle (Red arrow) placed over Calcific deposits under IITV* guidance (*IITV- Image intensifier television)and arthroscope(Black arrow) viewing from the anterolateral portal and knee in Extension

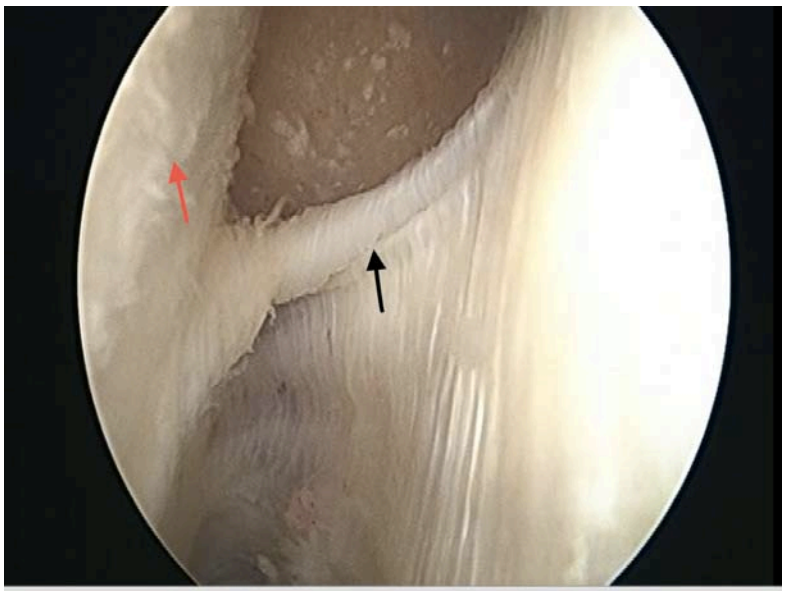

Figure 4a: Bands over Lateral Gutter

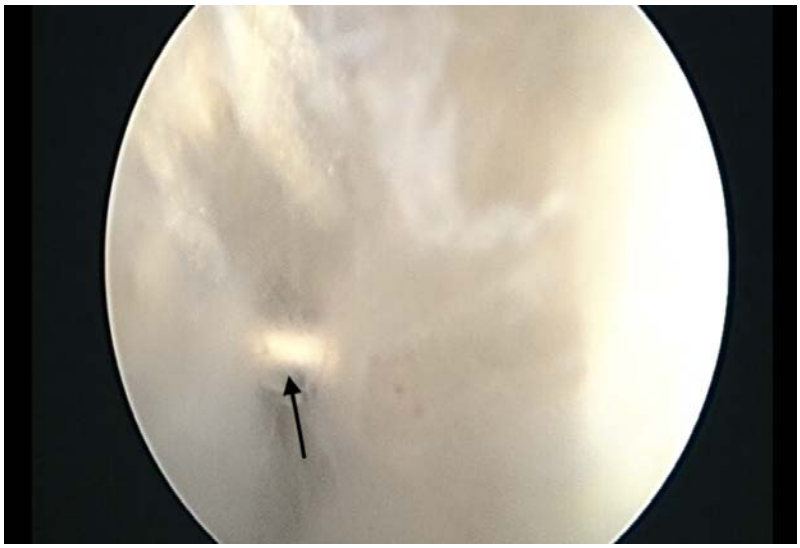

Figure 4b: Lateral Epicondyle

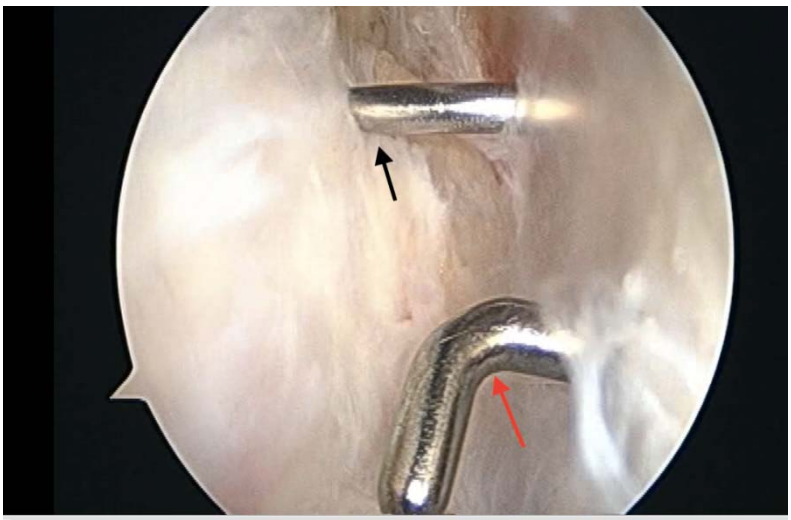

Figure 4c: Direct Lateral Portal

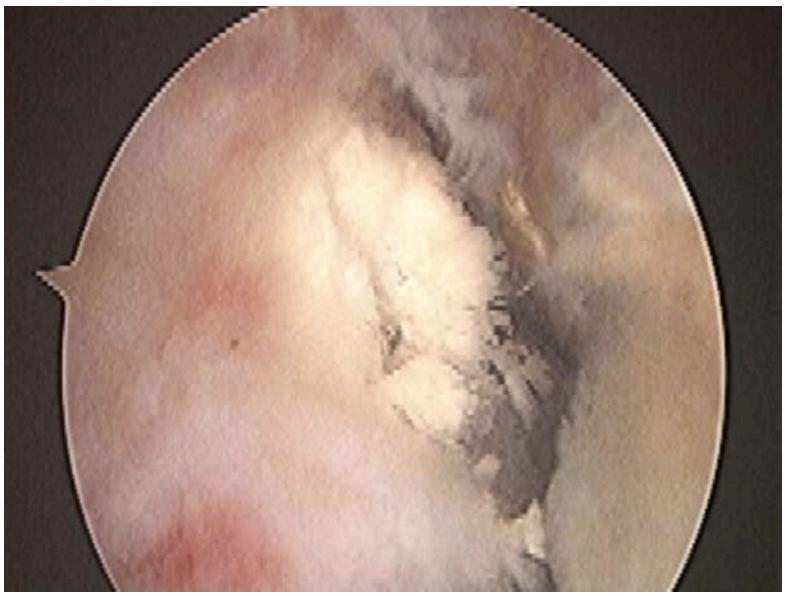

Figure 4d: Direct Lateral Portal

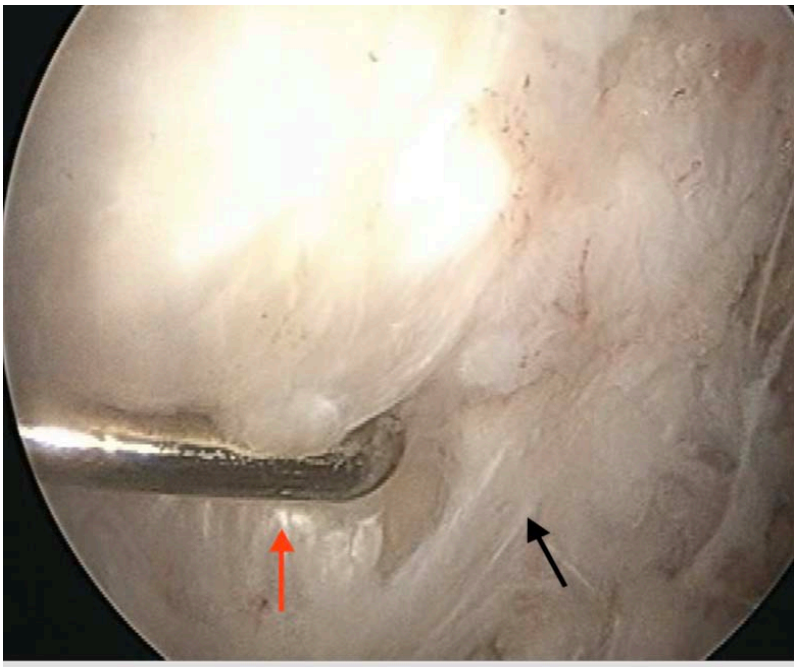

Figure 4e: Calcific Deposits in LCL

Fig. 4 a-e: (a) Lateral Band in the Lateral Gutter -(Red Arrow-Lateral Femoral Condyle, Black Arrow-Lateral Band) (b) Needle (Black arrow) over epicondyle identified from anterolateral portal (c) Probe in direct lateral portal (Red arrow) and Needle over lateral epicondyle (Black arrow) (d) Calcific deposits in the LCL, (e) LCL (Black Arrow) and Popliteus (Red Arrow) as seen from direct lateral portal

The LCL and popliteus were dissected (Fig. 5), calcific deposits in the LCL was debrided by switching the arthroscope and shaver between the anterolateral portal and direct lateral portals. A small part of the LCL was shaved at the area of calcific deposit and all the deposit was squeezed out. Intactness of the LCL was confirmed with Varus stress test and the opening of the lateral joint was confirmed under IITV guidance (Fig. 6 a, 6b).

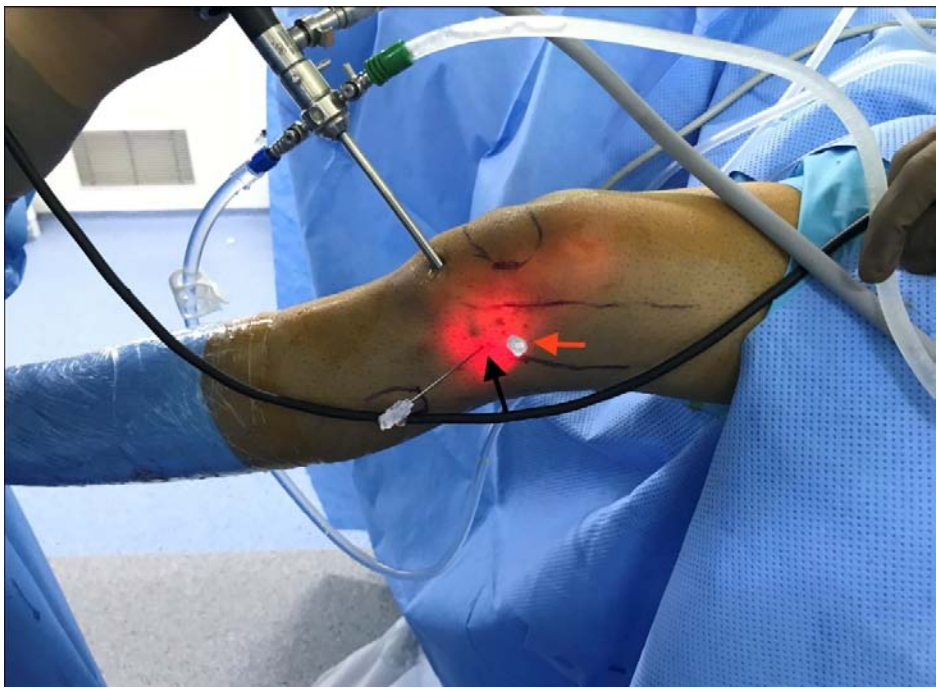

Figure 5: LCL and Popliteus

Fig. 5: Direct lateral portal-(Red Arrow-Needle over lateral epicondyle and Black arrow-Direct Lateral Portal)

Figure 6a: IITV Guidance

Figure 6 b: IITV Guidance

Fig. 6: a -IITV image after removal of calcific deposits (b) Valgus test to reconfirm the intactness of LCL

Medial meniscus root tear was repaired with pull-through suture technique.

III. Discussion

Calcific deposits in the lateral collateral ligament of the knee has been described in the literature[1-5].The condition is described in the middle and old age group[6].Open excision of calcific deposit has also been described in the literature[7,8], but arthroscopic excision has not been described in the literature. In a study by Hyoung Hoo Kim et al[9], they performed open excision of the calcific deposit which led to the disruption of the ligament, so the ligament had to be repaired back. To prevent ligament injury by the open technique, arthroscopic excision was conceptualized. Our concept of arthroscopic excision for the lateral side of the knee is inspired from a case report by Shenoy PM et al who excised calcium deposit from popliteus[10].

We considered the feasibility of direct lateral portal and extensively studied and planned the portal. We performed cadaver study on 2 knees at a cadaver lab and further dissected the knee to know the safety of the portal (Fig. 7 a). On cadaver dissection of the direct lateral portal, the skin was incised to reach Iliotibial band (IT) (Fig. 7 b). IT band was excised to visualize lateral epicondyle (Fig. 7c and d), the upper part of LCL and popliteus.

Figure 7a: Cadaver Knee

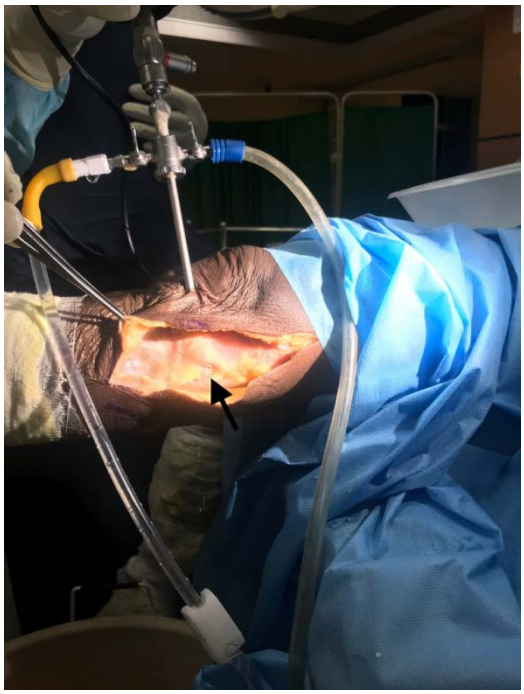

Figure 7b: Iliotibial Band

Figure 7c: Lateral Epicondyle

Figure 7d: Lateral Epicondyle

Fig. 7a-d: Cadaver dissection images. (a) Marking of lateral epicondyle (black arrow) and Direct Lateral portal (red arrow) (b) Direct Lateral Portal (black arrow) after skin flaps are dissected (c) Iliotibial band (Red arrows) Portal is at safe distance from common peroneal nerve (d) LCL detached from origin to confirm the exact origin of LCL (Black arrow showing LCL)

Lateral epicondyle is 23.97 mm (sd 3.27) from the distal joint line and 24.42 mm (sd 3.14) from posterior joint line[11]. LCL insertion is located 1.4mm proximal and 3.1mm posterior to the lateral epicondyle in a small bony depression[12]. Popliteus attachment is 18.5mm anterior and inferior to LCL insertion[12]. We safely dissected anterior to the common peroneal nerve and also did not damage the LCL fibers while making the portal.

Looking at the safety of this portal, we performed an arthroscopic debridement of calcific deposit in LCL in 2 patients. Along with standard anterolateral, anteromedial portals, a superolateral portal was made. Through the superolateral portal, bands in the lateral gutter were shaved with arthroscopic shaver and then a 'direct lateral portal' was done 1cm inferior and 1cm posterior to lateral epicondyle to visualize the LCL. This portal is anterior to the anterior border of the fibula, so there is no risk of injury to the common peroneal nerve. Calcific deposits in the LCL were identified and debrided by switching the arthroscope and shaver between the anterolateral portal and direct lateral portals. Finally, intactness of LCL was confirmed by varus stress test and recorded with C-arm. Postoperative X-ray (Fig. 8 a,b) shows the completeness of evacuation of calcification from the lateral side of the knee.

Figure 8a: Post-Operative X-ray

Figure 8b: X-ray Showing Complete Evacuation of Calcification

Fig. 8: Postoperative X-ray Knee AP and lateral views showing clearance of calcific deposits.

We are the first in the literature to describe arthroscopic excision of calcific deposit in LCL by a new portal 'Direct lateral portal' or 'Bengaluru Chandrashekar portal' for the knee. With this new innovative technique in arthroscopy, the utilization of arthroscopy technique has been amplified. We have utilized it to debride the calcific deposits in the femoral side of LCL and Popliteus, to visualize isometric point of femoral side reconstruction of anterolateral ligament (ALL), and also for visualization and repair of femoral avulsion of LCL and Popliteus.

Declarations of Interest
None

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A Comparative Study of Outcomes of Treatments for Radiculopathies Arising out of Single Level Disc Prolapse of Lumbar Spine Treated with Epidural Steroid Injections Versus Conservative Management

By Amit Garud, Pradeep Kulkarni, Nishant Gaonkar & Vishal Sharma

Abstract- *Introduction:* Low back pain is one of the major causes of disability in people in 4th and 5th decade of life. Lumbar spinal stenosis can induce radiating pain in the lower limbs. Pain can be caused due to mechanical compression or nerve root irritation due to prolapse which causes radiculitis. Hence, in early disc degenerations, apart from conservative management, Epidural steroid injections have been used as an add-on in treating radiating pain as they have a potent anti-inflammatory property.

Materials and method: A total of one hundred patients with low back pain with unilateral or bilateral radiculopathy with documented with lumbar degenerative disc disease without any evident instability or neurodeficit were considered for our study. Patients were randomized and selected for further intervention for conservative management or for epidural steroid injections under fluoroscopic guidance. Results were evaluated by comparing the Visual analogue scale scores and Modified Roland Sciatica Scores at the end of six months.

Keywords: *epidural steroid injection, single level disc prolapse, lumbar degenerative disc disease.*

GJMR-H Classification: *NLMC Code: WE 725*

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Observations: In this study, it was observed that there was a significant decrease in pain and radiculopathy scores after immediately steroid injections which retained upto the entire study period of 6 months. In case of conservative management, the reduction in scores was more gradual.

Conclusion: Epidural steroid injections are an effective way for treating radiculopathy due to single level disc prolapse in lumbar spine as it reduces pain and radiculopathy early which encourages patients for active physiotherapy.

Keywords: epidural steroid injection, single level disc prolapse, lumbar degenerative disc disease.

I. Introduction

Low back pain and spine related impairments are one of the major concerns in 4th and 5th decade of life and has ranked as one of the most frequent cause leading to limitation of activity[1]. Lumbar spinal stenosis can induce radiating pain in the lower limbs through herniated intervertebral disc, thickening ofligamentumflavum, zygapophyseal joint and surrounding soft tissues[2]. Conservative management has been used widely for disc degenerative conditions. However, in many cases, structural abnormalities are not the only cause of pain, rather nerve root irritation due to disc prolapse and inflammation around nerve root causes radiculitis instead of direct mechanical compression[3,4].

Steroids are well known for its efficient anti-inflammatory properties[5]. Therefore, in the management of radicular pain produced by spinal stenosis, injected steroid is expected to contribute to pain reduction by interrupting the synthesis of prostaglandins, which in turn blocks the conduction of nociceptive-c fibers and controlling edema around the nerve root[5]. Hence, role of epidural steroids is that it can provide pain relief during the recovery of disc or nerve root injuries and allow patients to increase their level of physical activity.

Complications that can occur in patients receiving epidural steroid injections are injection site abscess, epidural hematoma and puncture of the dura. However, the most adverse immediate reaction during an epidural injection that can occur is vasovagal reaction. Headache without any evident dural puncture still can be seen in about 2% of patients and injection of air in the epidural space, increased intrathecal pressure due to fluid, possibly an undetected dural puncture are said to be the important causes. Accidental intravascular injections can occur because absence of blood after negative aspiration is a method that cannot be completely relied upon. Other minor complications can be non-positional headaches, facial flushing,low-grade fever, and transient increased back pain or radiculopathy. [6]

Epidural steroid injections are contraindicated if there is an evident systemic or local infection at the injection site, bleeding diathesis, uncontrolled diabetes mellitus, and congestive heart failure. If there are any unexpected anatomical anomalies, such as a midline epidural septum or multiple separate epidural

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compartments, the desired flow of epidural injectants to the presumed pain generator can be restricted.[6]

II. Materials and Methods

The study was conducted at a tertiary care hospital from November 2016 to November 2018.

a) Inclusion criteria

1. Patients with single level disc prolapse of lumbar spine having unilateralor bilateral radiculopathy.
2. Patients with clinical correlation of radiological finding.
3. Adults of either sex.

b) Exclusion criteria

1. Patients with clinical and radiological evidence of instability like spondylolisthesis or spondylolysis.
2. Patients with traumatic spine injury.
3. Patients with previous history of lumbar surgery or epidural injections.
4. Patients with neurological deficit.
5. Patients with relevant co-morbidities.
6. Patients with known allergy to the injecting materials.

A total of hundred patients who fulfilled the above mentioned criteria were included in the study. Patients to participate in this study were documented.

There were two groups created

- Epidural steroid injection group
- Conservative management group

Patients were randomized and allotted one group for the study. So, there were 50 patients in each group. Patients were asked to record their pain and radiculopathy status using Visual analogue scale and Modified Roland Sciatica Questionnaire. Each patient was counseled about the management, expected prognosis and probable complications.

Epidural injections were given under fluoroscopic guidance by initially injecting non-ionic contrast material using the technique of safe triangle targeting the exiting root. Once the correct placement is confirmed, a cocktail of triamcinolone acetate 40mg/1cc with 0.25mg of Bupivacaine is injected at the target site. After one hour, their pain and radiculopathy status was recorded using Visual Analogue scale (VAS). Immediate post injection Modified Roland sciatica (MRS) scores cannot be recorded as it is a lifestyle scoring system. Patients were discharged usually on the same day with pregabalin 75mg HS. Patients treated conservatively were prescribed routine non-steroidal anti-inflammatory drugs with pregabalin in increasing dosage of a maximum of 450mg/day.

Patients in both groups were advised active physiotherapy with lumbar exercises to strengthen lumbar paraspinal muscles, postural improvements and to improve disc biomechanics. Patients were explained about the necessary precautions like avoiding forward bending, heavy weight lifting, excessive two wheeler travelling, etc., which is likely to worsen the disease. Patients were asked to report back after one, three and six months routinely or as and when patient finds it a need to visit their doctor. Patients were again asked to report their pain using VAS scale and their radiculopathy status using MRS Questionnaire. Patients who had developed any neurological deficit in the course of study or those who came with evident instability on follow up were dropped out of study and was reconsidered for appropriate further management.

III. Observations and Results

A prospective, comparative clinical study was conducted with 100 patients. There were equal number of patients in each group consisting of 50 patients. In epidural injection group, mean VAS score pre-injection in was 5.64(+/- 0.86) and mean MRS score pre-injection was 51.84 (+/-12.91) while in conservative group, at the beginning of treatment, mean VAS score was 5.80 (+/-0.86) and mean MRS score was 49.40 (+/-12.20). None of the distributions were significant at the pre-treatment stage. (Table 1 and 2)

Table 1: VAS scores comparison within each group and between the two groups

VAS Score	Epidural Group		Conservative group		Comparison between two groups
	Mean	SD	Mean	SD	P value
Pre-treatment	*5.64*	0.860	*5.80*	0.866	>0.05
Immediate post treatment	*2.04*	0.889	-	-	-
1 month	*2.88*	0.881	*4.68*	0.900	<0.05
3 month	*3.12*	1.236	*4.24*	1.393	<0.05
6 month	*2.76*	1.165	*3.94*	1.361	<0.05

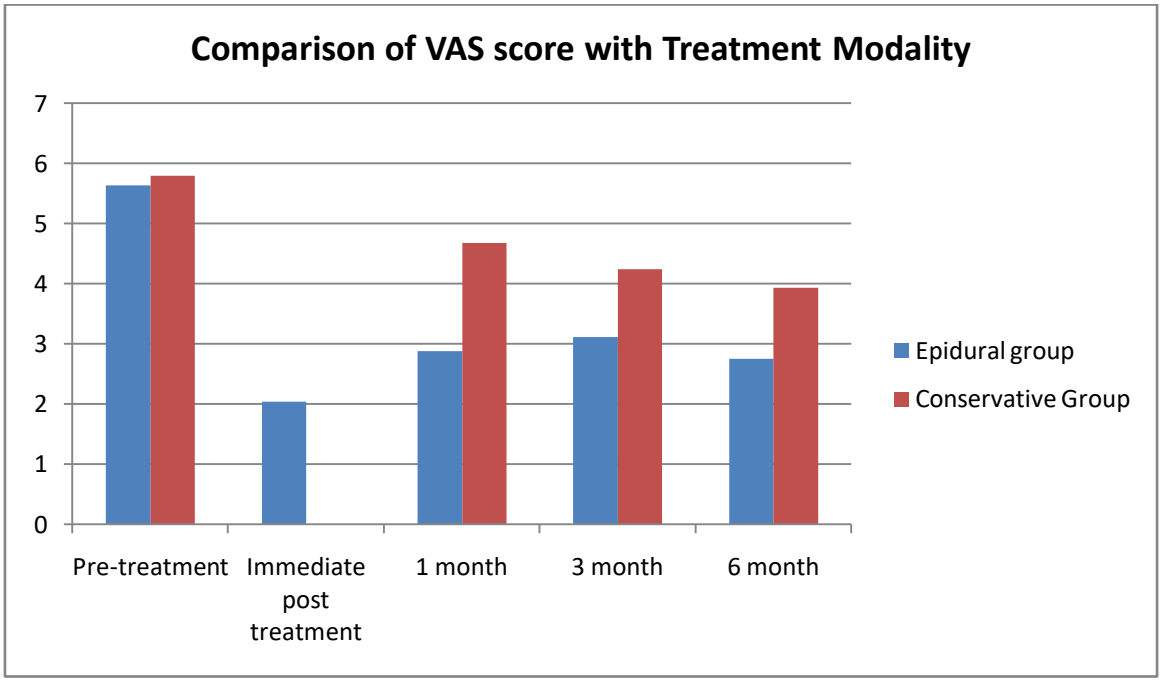
Table 2: MRS scores comparison within each group and between the two groups

MRS Score	Epidural Group		Conservative group		Comparison between two groups
	Mean	SD	Mean	SD	P value
Pre-treatment	*51.84*	12.912	*49.40*	12.207	>0.05
1 month	*32.20*	13.454	*43.40*	13.156	<0.05
3 months	*34.20*	13.191	*42.80*	13.799	<0.05
6 months	*34.68*	14.673	*39.72*	12.628	<0.05

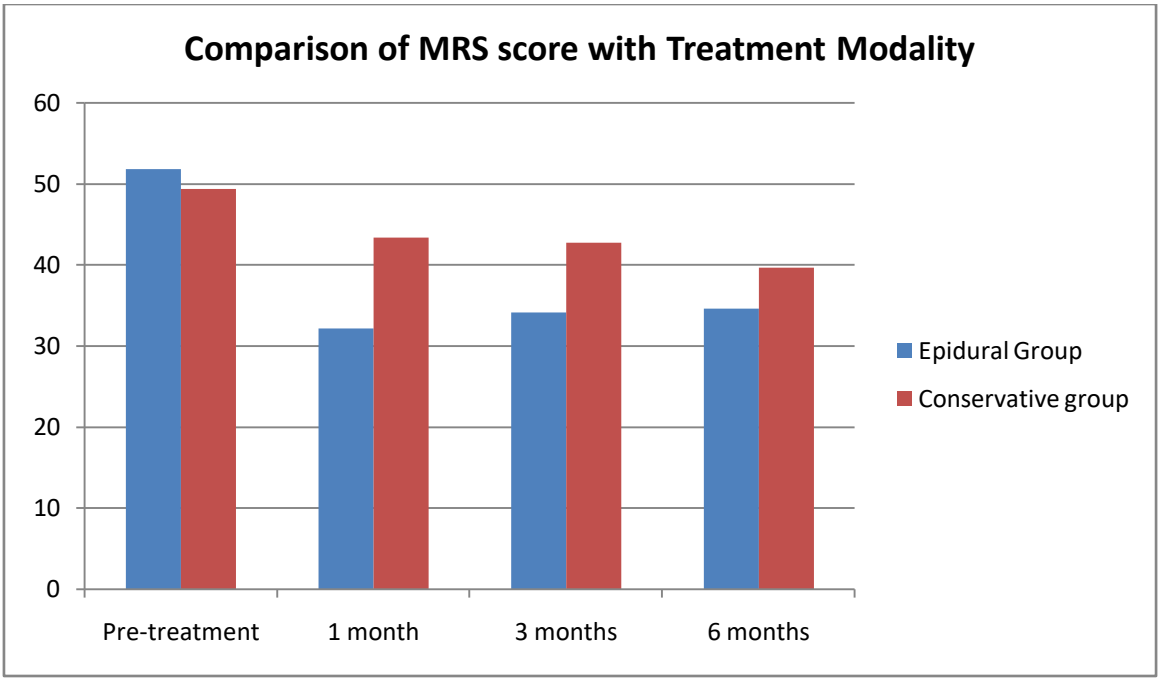
In our study, we observed that after immediate post-injection, mean VAS score in epidural injection group was 2.04+/-0.89 These scores were reduced significantly as compared to pre-injections ($p<0.05$).

At 1st month follow up, mean VAS score was 2.88+/-0.88 in epidural injection group and 2.68+/-0.90 in conservative group. When compared to immediate post injection, it was observed that mean VAS score had increased significantly ($p<0.05$) in epidural injection group. Mean MRS score at 1st month follow up was 32.20+/-13.45 epidural injection group and 33.40+/-13.16 in conservative group. When compared to pre-injection, it was observed that there was a significant reduction in mean MRS score ($p<0.05$) in epidural injection group. However, in conservative group, mean VAS score at the end of 1st month was 4.68+/-0.900 which was decreased significantly ($p<0.05$) as compared to pre-treatment score. Similarly, Mean MRS score at the end of 1st month was 43.40+/-13.15 which was decreased significantly ($p<0.05$) as compared to pre-treatment score. Reduction in VAS scores and MRS scores were better in Epidural group as compared to the conservative management.

On three and six months follow up, both pain and radiculopathy scores remained similar in both the groups without being statistically significant as compared to their previous scores within the group. However, the difference in the two groups was still persistent and was significant statistically. (Graphs 1 and 2)

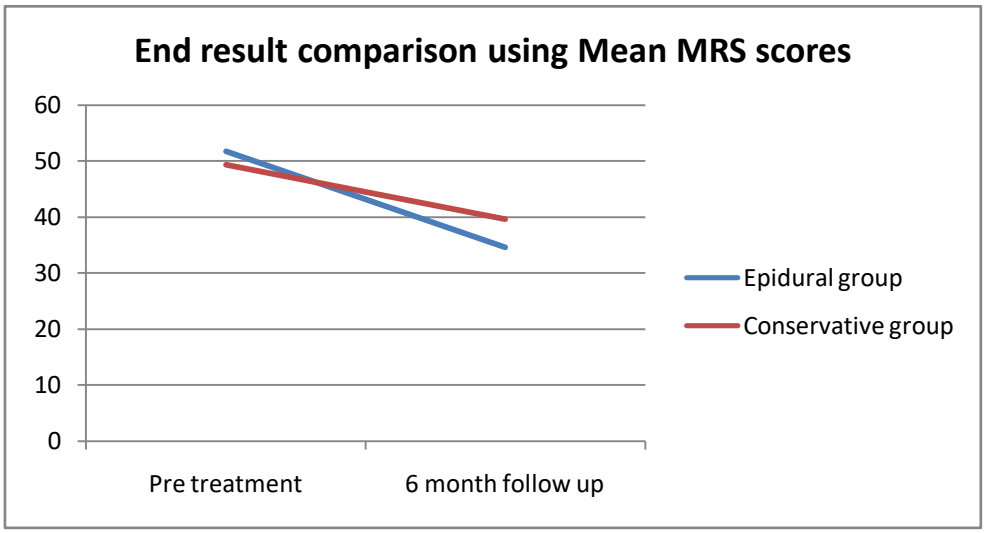


Graph 1: Comparison of VAS score with Treatment Modality



Graph 2: Comparison of MRS score with Treatment Modality

On comparing the end result of the two modalities (Graph 3), we observed that there was still a significant reduction the pain scores and radiculopathy scores in epidural injection group which was better as compared to conservative management. ($p<0.05$).



Graph 3: End Result comparison

In our study, none of the patients had any major complication. Two patients in epidural injection group had post injection headache which resolved spontaneously without the need of any active intervention.

IV. Discussion

When we observed the trend of scores and their improvement patterns in both the groups, we can see that there was a major improvement in scores immediate post-injection as compared to pre-injection which carried away with follow up with minor variations in epidural injection group. In case of conservative management, we also observed that there was a significant improvement at the end of 6 months, but this improvement was gradual as compared to the injection group

However, at the end of six months, when we compared the difference in the two groups, we can clearly see that there was a significant improvement in scores at the end of six months when compared with pre-treatment and both the treatment modalities were

effective but the scores at the end of six months were found to be significantly better in epidural injection group as compared to conservative management.

In our study, two patients had post injection headache in epidural group. There are various possible causes like an un-noticed dural puncture, which is less likely as it resolved spontaneously. Other probable cause could be injection of air into the epidural space.

In our study, a significant number of patients retained their improved scores throughout the study period. Various probable mechanisms which may have a role in improvement could be the steroids and bupivacaine solution, both have anti-nociceptive and nerve membrane stabilizing properties; the washout effect of the solution, which decreases the regional levels of inflammatory mediators; hydrodilation effect of the solution breaking the adhesions around the nerve root; steroids having a potent anti-inflammatory property; rehabilitation protocol which improves the biomechanics on the discs[7,8].

In our study, we have chosen single dose injections as our protocol because repeated injections of steroids and local anesthetics may mask the symptoms of disease progression or development of instability.

In case of epidural steroid injections, as the cocktail of steroid and local anesthetic act directly over the site of inflammation, patients are relieved almost instantly and are more enthusiastic to follow the physiotherapy protocol which is not the case in conservative management which takes a while hence difficult and reluctant to comply with the physiotherapy.

V. Conclusion

Epidural steroid injections can be considered to be effective in treating radiculopathies arising out of early stages of prolapse intervertebral discs of lumbar spine. The short term results of epidural steroid injection were found to be superior as compared to conservative management. However, a good post injection protocol is necessary for good results and a close follow up is must to watch for disease progression and to avoid deterioration.

Conflict of interest: None

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A Comprehensive Review of Surgical Supplies

By A. K. Mohiuddin
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Abstract- Injury to the skin provides a unique challenge, as wound healing is a perplexing and multifaceted procedure. Intense wounds can possibly move from the intense wound to endless wounds, requiring the doctor to have a careful comprehension of outside intercessions to bring these wounds again into the healing course. Careful improvement/ dressings are applications for wounds, consumes, and ulcers. They ought to be viewed as steady of healing; are attractive however not fundamental in a crisis. There are right now a lot of dressings accessible in the market to help in wound healing. Before picking a dressing for particular damage, a doctor must evaluate cautiously the necessities of the wound to comprehend which dressing would guarantee most extreme intrigue. Fundamentally, there is nothing called best decision, and it is vital that the benefits/negative marks of each dressing framework be comprehended. This article has given a structure to help with dressing evaluation. This article uncovers estimation of wound healing and the elements of wound dressings. An assortment of dressings and their individual subtleties are point by point.

Keywords: *wound dressing; gauzes; absorbent; cotton fiber; mesh; sponges; napkins.*

GJMR-H Classification: *NLMC Code: WE 168*

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Keywords: wound dressing; gauzes; absorbent; cotton fiber; mesh; sponges; napkins.

I. Background

Wound healing is a dynamic and complex procedure which requires appropriate condition to advance healing procedure. Generally, wet-to-dry dressings have been utilized broadly for wounds requiring debridement. In 1600 BC, Linen strips absorbed oil or oil secured with mortars was utilized to block wounds. Dirt tablets were utilized for the treatment of wounds by Mesopotamian starting point from around 2500 BCE. They cleaned wounds with water or milk before dressing with nectar or tar. Wine or vinegar use for cleaning the wounds with nectar, oil and wine as further treatment was trailed by Hippocrates of old Greece in 460-370 BCE. They utilized fleece bubbled in water or wine as a gauze. There was a noteworthy leap forward in the clean procedure during the nineteenth century, anti-infection agents were acquainted with control contaminations and reduction mortality. Present day wound dressing landing was in 21th century. Woven spongy cotton bandage was utilized in 1891. Until the mid-1900's, it was solidly accepted that wounds mended all the more rapidly whenever kept dry and revealed while 'shut wounds recuperate more rapidly than open wound' written in an Egyptian restorative content - Edwin smith careful papyrus in 1615 BC. Oscar Gilje in 1948 portrays clammy chamber impact for healing ulcers. In the mid 1980's, the main present day wound dressing was presented which conveyed significant attributes giving dampness and retaining liquids (for example polyurethane froths, hydrocolloids, iodine-containing gels). During the mid-1990's, manufactured wound dressings ventured into different gathering of items which incorporates hydrogels, hydrocolloids, alginates, engineered froth dressing, silicone networks, tissue cements, vapor-porous cement movies and silver/collagen containing dressing. At the point when the wound is shut with dressing they are ceaselessly presented to proteinases, chemotactic, supplement and development factors, which is lost in the wound uncovered. In this way, during late twentieth century, generation of occlusive dressing started to secure and give clammy condition to wound. These dressings help in quicker re-epithelialization, collagen combination, advances angiogenesis by making hypoxia to the wound bed and diminishes wound bed pH which prompts decline in the wound disease. With the progression in innovation, in excess of 3000 items have been created to treat various kinds of wounds by focusing on different parts of healing procedure.

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Figure 1: Surgical dressing for wound healing (Source: 4g Inwi Configuration)

a) Purpose of the study

Discussion and projection of wound healing by market accessible careful supplies. The present audit follows the historical backdrop of dressings from its soonest origin to the present status and furthermore talks about the preferred position and restrictions of the dressing materials.

b) Findings

There is a mind-boggling measure of wound dressings accessible in the market. Present day world and innovation offered ascend to different method for wound healing with advancements. Practically a wide range of advancements are accessible in careful outlets, a couple of them are restricted to medical clinic settings. This suggests the absence of full comprehension of wound consideration and the board. The purpose of utilizing propelled dressings is to enhance explicit wound attributes to carry it as near "perfect" as could be allowed. It is simply after appropriately evaluating the wound qualities and getting learning about accessible items that the "perfect" dressing might be picked.

c) Materials and Methods

Research led an all year extensive writing search, which included specialized pamphlets, papers diaries, and numerous different sources. The present examination was begun from the earliest starting point of 2018. PubMed, ALTAVISTA, Embase, Scopus, Web of Science, and the Cochrane Central Register of was altogether looked. The catchphrases were utilized to look for changed distributers' diaries like Elsevier, Springer, Willey Online Library, Wolters Kluwer were broadly pursued. Drug and specialized specialists, pharma organization delegates, medical clinic attendants and scientific experts were given their profitable recommendations. Projections depended on various sorts of careful supplies accessible in home and abroad.

d) Research limitations

Pictorial introduction of such a significant number of sorts of dressings are unrealistic to imitate in an article yet for a speedy survey, the article involves the majority of them. Likewise, sutures are not point by point which will be incorporated by the following article.

e) Practical Implication

The sole of this article was to detail a few kinds of careful supplies. Alongside understudies, specialists and experts of various foundation and controls, for example Advisors, medical procedure partners, specialists, attendants, emergency clinic experts and pharmacists need to procure much from this article.

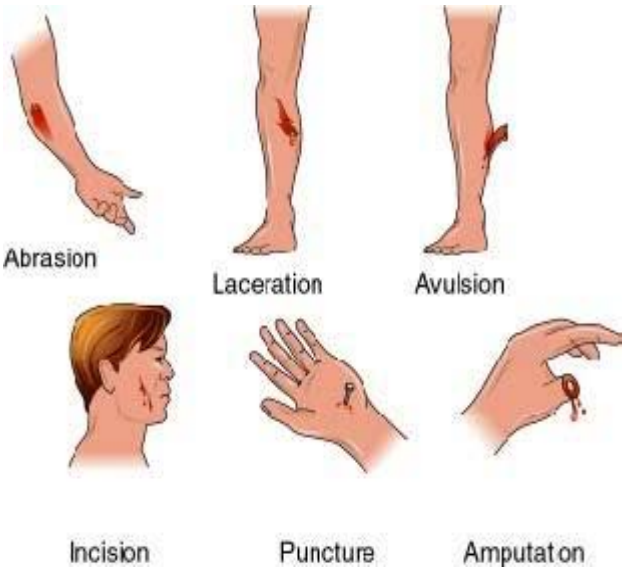
II. Introduction

A professional service rendered by many pharmacists consists of supplying surgical instruments, sutures, surgical dressings, and other equipment employed by the surgical personnel during and after a surgical operation. Some pharmacists who have obtained the necessary background of information

carries a complete line of such supplies and even are able to provide operating tables and other heavy equipment. There are comparatively few such completely equipped pharmacies; the major outlet is through surgical supply houses. Every pharmacist, however, should be familiar with two of the products mentioned above, namely, Surgical Dressings and Sutures, which are discussed in detail below. The selection of the correct type of surgical dressing or suture is a crucial factor in protecting the welfare of the patient undergoing surgery. Many items in these categories are handled routinely by pharmacists, and all of these items come within the purview of their professional responsibility.

a) Types of Wounds

An intense wound is damage to the skin that happens abruptly because of mishap or careful damage. It recuperates at an anticipated and expected time span more often than not inside 8-12 weeks relying upon the size, profundity and the degree of harm in the epidermis and dermis layer of the skin. Ceaseless wounds for the most part result from decubitus ulcer, leg ulcer and consumes. Wound healing is a dynamic and complex procedure of tissue recovery and development advance through four unique stages (I) the coagulation and hemostasis stage (following damage); (ii) the fiery stage, (soon after damage to tissue) during which swelling happens; (iii) the expansion time frame, where new tissues and veins are shaped and (iv) the development stage, in which renovating of new tissues happens.



(Source: Blog wound infection management tips Saturday, May 22, 2010)

Figure 2: Types of wounds

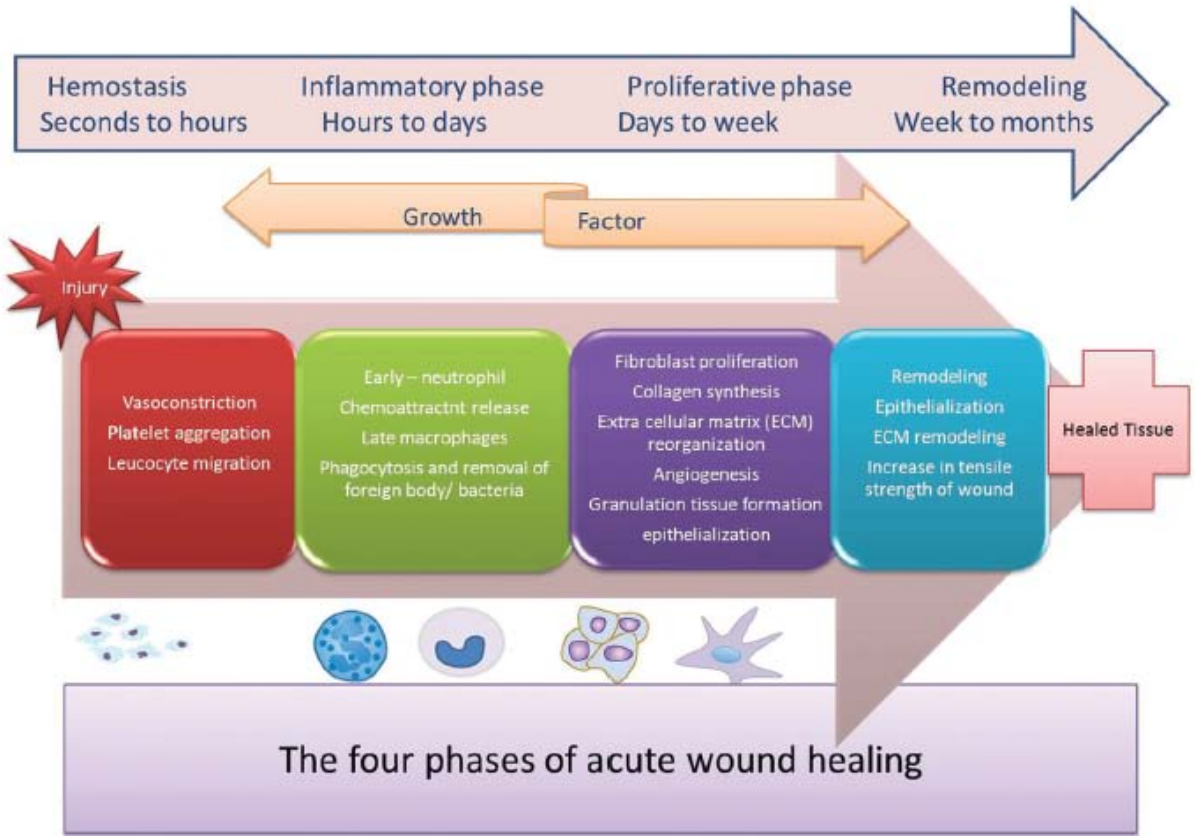


Figure 3: Distinct and overlapping phases of wound healing [4]

There are a limited number of reasons a wound becomes chronic; however, once these reasons are rectified, the wound resumes its natural course of healing.

- *Arterial:* Generally, an ABI of under 50 mm Hg, or a flat-out toe pressure under 30 mm Hg (or under 50 mm Hg for people with diabetes) demonstrates basic appendage ischemia and predicts disappointment of wounds to mend.
- *Venous:* Pressure-incited changes in vein divider penetrability at that point lead to spillage of fibrin and other plasma parts into the perivascular space. Collection of fibrin has immediate and negative impacts on wound healing as it down-directs collagen combination.
- *Infection:* Underlying irresistible procedures including cellulitic and osteomyelitis procedures will repress wound healing. Refined for vigorous, anaerobic, and contagious pathogens is suggested.
- *Pressure:* Increased pressure to the territory of concern will obliterate new tissue development and counteract appropriate perfusion of blood to the wound site. These regions should be offloaded to maintain a strategic distance from pressure in the territory.
- *Oncologic:* Always biopsy territories of worry in nonhealing wounds, as this can be an atypical introduction of certain kinds of malignancies.
- *Systemic:* There are different foundational ailments which hinder wound healing, with diabetes being the most well-known offender. It has been resolved that uncontrolled blood glucose levels smother the body's ordinary provocative reaction, just as causing microvascular malady which cutoff points healing.
- *Nutrition:* While serum egg whites has not been observed to be a decent indicator wound healing, there is some proof that protein hunger, just as inadequate degrees of specific nutrients and minerals, will confine the body's capacity to mend constant wounds.
- *Pharmacological:* Hydroxyurea has been accounted for in various cases to cause nonhealing ulcerations.
- *Self-incurred/psychosocial:* There are cases where a patient is causing the ulceration, either deliberately or because of resistance. This is frequently the hardest factor to spot and survive, however should dependably be a thought [1-7].

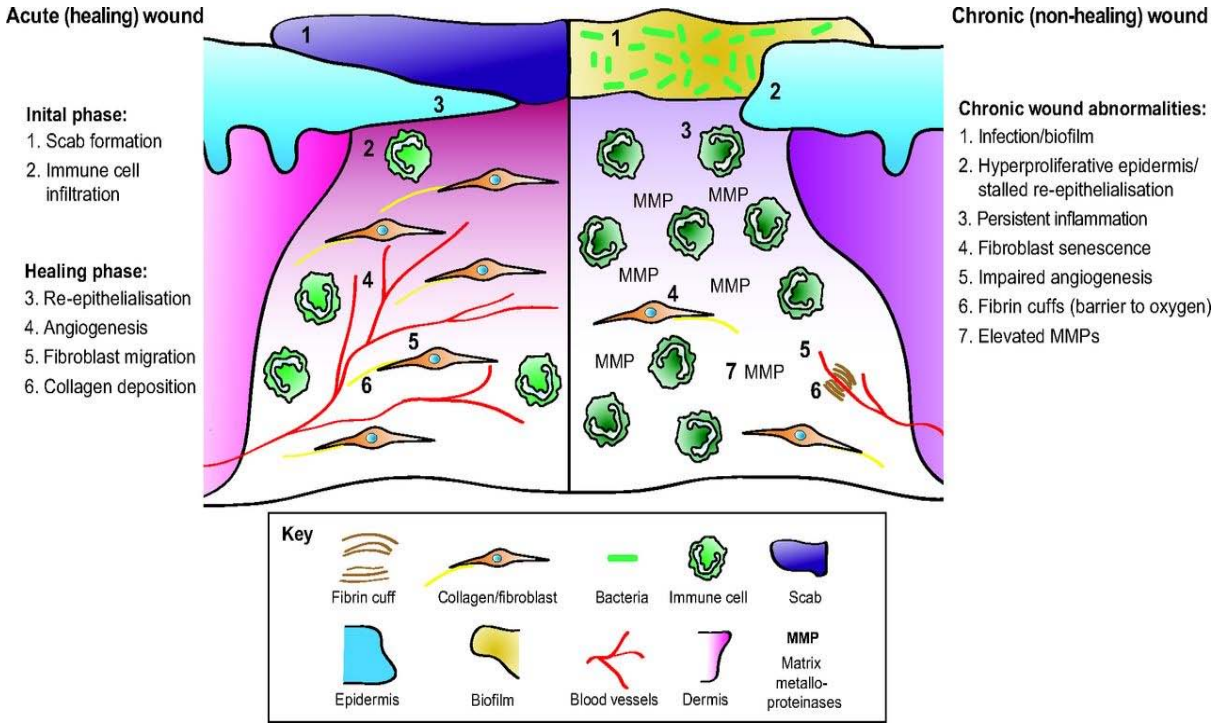


Figure 4: The cellular and molecular differences between acute healing wounds and chronic non-healing wounds [7]. The healing of intense wounds (left) starts with a transient provocative reaction as granulation tissue is framed, which gives a situation appropriate to the re-epithelialization required to finish fix. Constant non-healing wounds (right) are regularly tainted and display persevering aggravation. By definition, re-epithelialization has slowed down yet is hyper-proliferative. Granulation tissue is problematic with raised lattice metalloproteinases (MMPs) present together with poor fibroblast and vein invasion. Fibrin sleeves can likewise be available that counteract the dissemination of oxygen through the wound, rendering it hypoxic.

b) Uses of Dressings

Surgical dressing is a term applied to a wide array of products used for dressing physical injury or diseased tissues. Dressings may serve to:

- Provide a domain for soggy wound healing. Drying up of a wound is a main consideration in improving damage healing and expanding seaming. Dressings that avert drying up give an ideal situation to autolysis cell movement, granulation, and re-epithelialization.
- Prevent maceration by allowing dissipation or assimilation. In very secretory wounds, unnecessary dampness and autolytic chemicals will debilitate fixing tissue and will expand odds of microbial infection.
- Promote hemostasis.
- Protect the wound from further harm (mechanical harm, microbial intrusion, lack of hydration, maceration, synthetic harm, change in pH).
- Reduce heat misfortune.
- Control microbial development (by joining of antimicrobial medications).
- Promote autolysis.
- Promote healing.
- Provide pressure, advancing hemostasis, and decreasing edema.
- Provide support.
- Reduce torment, increment patient solace, and improve useful utilization of wound site.
- Reduce smell.
- Improve the presence of the wound site.
- Reduce in general expenses related with wound treatment [8-12], [25].

c) Selection of Wound Dressing

In view of the wound kind, appropriate dressing material must be utilized. Dressing choice ought to be founded on its capacity to a) give or keep up soggy condition b) upgrade epidermal movement c) advance angiogenesis and connective tissue amalgamation d) permit gas trade between wounded tissue and condition e) keep up fitting tissue temperature to improve the blood stream to the wound bed and improves epidermal relocation f) give insurance against bacterial infection and g) ought to be non-disciple to the wound and simple to evacuate in the wake of healing h) must give debridement activity to upgrade leucocytes movement and bolster the amassing of compound and I) must be sterile, non-dangerous and non-unfavorably susceptible. Likewise, determination ought to be made based on the level of exudation, nearness or probability of infection, nearness of necrotic tissue, and anatomical site. The right choice of a wound dressing depends on the sort of wound as well as on the phase of fix. The utilization of a wound dressing can't be considered in seclusion, but instead with regards to an incorporated wound-care program [13-18].

d) Types of Wound Dressings

Within this classification, dressings are considered on the basis of use.

- Primary/secondary wound dressings
- Secondary dressings
- Absorbents
- Bandages
- Adhesive tapes
- Protectives [19, 20]

e) Specifications

Surgical dressings and sutures are required to meet specific requirements of the USP for many characteristics. For these specific requirements and the performance of several of the official tests, eg, Absorbency test and Fiber length of cotton, Diameter of sutures, and Tensile strength of sutures, textile fabrics, and films refer to the detailed instructions provided in the USP [21-24].

III. Classification

For all intents and purposes, the natural technique for characterization utilizes the terms essential and auxiliary dressing. An essential dressing legitimately contacts the wound. It might give absorbability and may forestall drying up, infection, and attachment of the auxiliary dressing to the wound. An auxiliary dressing is put over an essential dressing, giving further protect, absorbability, compaction, or impediment [24-29]. Albeit a few dressings are exclusively essential or optional in nature, others have the qualities of both. The accompanying arrangement is utilized here:

a) Primary Wound Dressings

i. *Plain Gauze*

Plain Gauze has been used as a primary dressing but willstick to all but clean, engraved wounds. In spite of the fact that this property has been utilized to unbridle exudative, tainted, and necrotic wounds, this training might be excruciating and is frequently broken, causing the expulsion of injury tissue and new epithelium [15], [25], [30]. Bandage and non-woven wound dressings are dry woven or non-woven wipes and wraps with fluctuating degrees of sponginess, in view of plan. Texture arrangement may incorporate cotton, polyester or rayon. Accessible sterile or non-sterile in mass and with or without a glue fringe. They are utilized for purging, pressing and covering an assortment of wounds [31].

(Source: Web Indiamart)

Figure 5: White Plain Gauze Bandage

ii. *Impregnated Gauze*

Impregnated Gauze is used to reduce its adherence to wounds. Cotton, rayon, or cellulose acetic acid derivation cloth has been impregnated with an assortment of substances, for example, oil or paraffin (Aquaphor, Beiersdorf, Vaseline (Sherwood), KY jam (Johnson and Johnson), petrolatum emulsion (Adaptic, Johnson and Johnson), zinc saline (NutraDress, Derma Sciences), or sodium chloride (mesalt, SCA Molnlycke). Coatings may wear off, permitting epithelial ingrowth and requiring a dressing change [32-35]. Operators most normally utilized incorporate saline, oil, zinc salts, petrolatum, xeroform and red. Signs change dependent on the compound. They are non-disciple and require an auxiliary dressing. An optional dressing ought to be utilized with these dressings to counteract drying up, give sponginess, and forestall the passageway of pathogens. At the point when utilized with a proper auxiliary dressing, these dressings might be utilized in vigorously oozing wounds [20], [31]. Silver, in ionic or nanocrystalline structure, has for a long time been utilized as an antimicrobial operator especially in the treatment of consumes (as silver sulfadiazine cream). Iodine likewise can bring down the microbiological load in incessant wounds. Alert is required in patients with a thyroid infection inferable from conceivable foundational take-up of iodine. Metronidazole gel is regularly utilized for the control of smell brought about by anaerobic microbes [15].

(Source: eBay)

Figure 6: Dermagran SPD-21 Hydrophilic Impregnated Gauze Wound Dressings 4" x 4" - Box/15

iii. *Film Dressings*

Film Dressings (transparent film, occlusive or semi-occlusive) are films of polyurethane with acrylic or polyether adhesivesthat provide a semipermeable membrane to water vaporand oxygen yet are waterproof. Reasonable for level, shallow wounds with low to medium exudates. Advance soggy condition. Hold fast to sound skin yet not to wound. Permit visual checks. May be left set up a few days. Give no padding. Not for contaminated or vigorously oozing wounds [15]. In softly radiating wounds they license enough disintegration to advance soggy wound healing and

avert maceration. Film dressings dispose of microbes from wounds and license washing and consideration of the wound. Film dressings will cling great to flawless skin and have a low adherence for wound tissue. They ought not be utilized in contaminated or vigorously radiating wounds. Film dressings may wrinkle, framing channels for microbial passageway. Trouble in taking care of film dressings has been overwhelmed by extraordinary plan of different application frameworks [102]. Notwithstanding their utilization as wound dressings, glue movies have been utilized to ensure regions helpless against pressure, grating, or shear ulceration or for imbuement or cannulation locales. these dressings are profoundly versatile and adaptable, and can fit in with any shape and don't require extra tapping. Examination of wound conclusion is additionally conceivable without expulsion of wound dressing due to straightforward movies. Subsequently these dressings are suggested for epithelializing wound, shallow wound and shallow wound with low exudates [3]. Instances of straightforward film dressings are Opsite™, Tegaderm™, Biooclusive ™, Bioclusive (R) Transparent Dressing (Johnson and Johnson), Opsite (Smith and Nephew), Tegaderm (3M), and Dermasite (Derma Sciences) [36-40].

(Source: Wound Care Advisor)

Figure 7: Transparent Film Dressing

b) Primary/Secondary Wound Dressings

i. *Composite Dressings*

Composite Dressings have primary and secondary componentsthat prevent adherence to the wound, with some degreeof absorbency. The level of impediment given by these dressings shifts. Discharge (Johnson and Johnson), Telfa (Kendall), and Melolin (Smith and Nephew) comprise of gently permeable rayon or cotton cushions sandwiched between permeable polyethylene films. Nu-Derm (Johnson and Johnson) and Lyofoam A (Seton Healthcare Group) comprise of polyurethane froths with a film backing [32], [41-43]. A composite or mix dressings has different layers and each layer is physiologically particular. A large portion of the composite dressings have three layers. Composite dressings are wound covers that consolidate physically unmistakable segments into a solitary item to give different capacities, for example, a bacterial obstruction, assimilation, and attachment. Ordinarily, they are made out of numerous layers and fuse a semi-or non-follower cushion that covers the wound. May likewise incorporate a cement outskirt of non-woven texture tape or straightforward film [26]. External most layer shield the wound from infection, center layer typically made out of absorptive material which keeps up dampness condition and help autolytic debridement, base layer made out of non-disciple material which keeps from adhering to youthful grinding tissues. Composite dressings have less adaptability and they are progressively costly [103].

(Source: Fashion Herald)

Figure 8: Composite Dressing

ii. *Hydrogels*

Hydrogels are insoluble hydrophilic materials made from synthetic polymers such as poly (methacrylates) and polyvinyl pyrrolidine. The high-water substance of hydrogels (70-90 %) helps granulation tissues and epithelium in a damp domain. They are mind boggling grids in which the scattering medium is caught rather like water in an atomic wipe. Hydrogels are nonadherent dressings that through semipermeable film permit a high rate of dissipation (and cooling) without trading off wound hydration. This causes them helpful in to consume treatment. Hydrogels are likewise helpful in shaggy regions where entanglement of hair into the dressing would not be awful [53], [110]. Delicate versatile property of hydrogels gives simple application and evacuation after wound is recuperated with no harm. Temperature of cutaneous wounds is diminished by hydrogels giving mitigating and cooling impact. Undefined hydrogel dressings are definitions of water, polymers and different fixings with no shape, intended to give dampness to a dry wound and to keep up a soggy healing condition. The high dampness substance serves to rehydrate wound tissue. Demonstrated for fractional and full-thickness wounds, wounds with putrefaction, minor consumes, and radiation tissue harm. Impregnated hydrogel wound dressings are bandages and non-woven wipes, ropes and strips soaked with a shapeless hydrogel [31]. Instances of hydrogels are Geliperm (Geistlich), Vigilon (Bard), Flexderm (Dow Hickam), and Nu-Gel (Johnson and Johnson). The last is held together with a fusible fiber scrim [44-47].

(Source: Healthy Kin)

Figure 9: Hydrogel Sheet Dressing

iii. *Hydrocolloid Dressings*

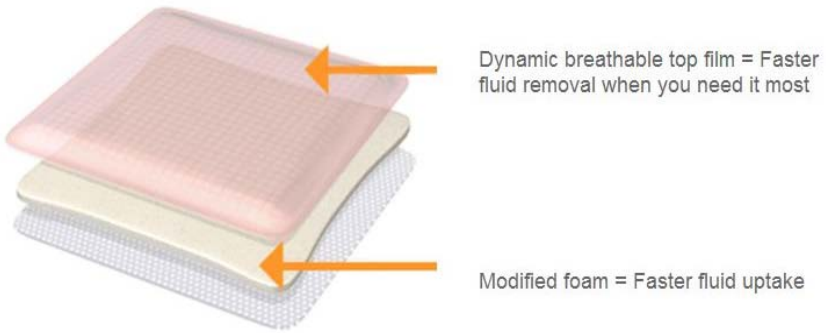
Hydrocolloid Dressings combine the benefits of occlusionand absorbency.Hydrocolloids are scatterings of particles around which water atoms and solvated particles structure a shell-like structure. Liquid assimilation happens essentially by molecule swelling and growth of this structure. The hydrocolloid mass of these dressings comprises of gum-like materials, for example, guar or karaya, sodium carboxymethyl-cellulose, and gelatin, bound by a cement, for example, polyisobutylene. Hydrocolloid dressings show wet tack (attachment to a wet surface) in light of molecule swelling. This property encourages atraumatic evacuation. The dry tack of hydrocolloid dressings is because of a glue, for example, polyisobutylene, which is inactivated by dampness [53]. The dry tack held by the dressing around the wound jam the edge seal. Exudate retention by most hydrocolloid dressings results in the arrangement of a yellow/darker coagulated mass that remaining parts on the wound in the wake of dressing evacuation. This might be wiped out from the wound and ought not be mistaken for discharge. Since hydrocolloids ingest water gradually, they are of little use on intensely radiating wounds. They are, be that as it may, helpful for respectably to profoundly exudative incessant wounds. Instances of hydrocolloid dressings incorporate Duoderm (ConvaTec), Comfeel Plus (Coloplast), and RepliCare (Smith & Nephew) [48-51].

(Source: health.planetfem.com)

Figure 10: Hydrocolloid Dressings

iv. *Hydro-cellular foam dressing*

Hydro-cellular foam dressing--Present day wound dressing, initiates soggy wound condition and advances wound healing. Bandage empowers scab development, which weakens epithelialization and increments vascular endothelial development factor (VEGF) articulation. Interestingly, hydro-cell froth dressing quickens epithelialization and new vessel development in granulation tissue [104]. Hydrocellular Foam Dressings with Silicone Adhesive are demonstrated for use on a wide scope of intense and constant wounds like venous leg ulcers, pressure ulcers, diabetic ulcers and horrendous wounds [31]. A hydrocellular froth dressing has turned into a first decision for the treatment of tolerably to vigorously radiating wounds which require exorbitant wound debridement for giving ideal conditions at the wound site while keeping up a wet wound condition [105,108]. may advance wound healing alongside reduction in aggravation by diminishing quality articulation levels of IL-1β, IL-6, and IL-10 [106]. Hydrocellular froth dressing (HCF) assimilates over the top wound liquid, which contains different cytokines and development factors, and guarantees a clammy domain to advance wound healing. Nonetheless, the sub-atomic instruments hidden the wound liquid segment changes instigated by HCF are inadequately comprehended. dermal fibroblast expansion is upregulated by HCF because of expanded leptin level at the wound surface, and these impacts advance wound healing [107].



(Source: HighTideHealth.com)

Figure 11: Allevyn Adhesive Hydrocellular Foam Dressings

v. *Calcium Alginate Dressings*

Calcium Alginate Dressings are a solid, flexible, and common wound consideration dressing normally connected to diabetic wounds, venous wounds, full-thickness consumes, split-thickness unite giver destinations, pressure ulcers, pit wounds, and endless ulcers. Alginate dressings can likewise help wounds that are draining [110]. The calcium in these dressings settles blood stream, which moderates draining [25]. Alginic corrosive is a normally happening polysaccharide gotten from dark colored kelp. As the calcium salt, these stringy nonwoven dressings are exceptionally retentive and are utilized on reasonably to exceedingly oozing wounds [13]. They might be held set up with cloth tape or a film dressing. They likewise might be utilized to pack wounds. Alginate dressings can ingest up to multiple times their weight in wound liquid [13, 25]. Instances of calcium alginate dressings are Sorbsan (Dow Hickam), Algosteril (Johnson and Johnson), and Kaltostat (Calgon Vestal) (Table 1) [52-56].

Table 1: Commercially available alginate-based dressings [109]

Commercially Names	Composition	Applications
Algicell™	Sodium alginate, 1.4% silver	Diabetic foot ulcer, leg ulcers, pressure ulcers, donor sites, and traumatic and surgical wounds.
AlgiSite M™	Calcium alginate	Leg ulcers, pressure ulcers, diabetic foot ulcers and surgical wounds.
Comfeel Plus™	Sodium carboxymethylcellulose and calcium alginate	Ulcers such as venous leg ulcers, pressure ulcers; burns, donor sites, postoperative wounds and necrotic wounds.
Kaltostat™	Sodium alginate	Pressure ulcers, venous ulcers, diabetic ulcers, donor sites, and traumatic wounds.
Sorbsan™	Calcium alginate	Arterial, venous, and diabetic leg ulcers Pressure ulcers, post-operative wounds, donor and graft sites and traumatic wounds.
Tegagen™	Sodium alginate	Diabetic and infected wounds.
Guardix-SG®	Sodium alginate and poloxamer	To avoid post-operative adhesions in thyroid and spine surgeries.
SeaSorb®	Calcium alginate	Good for high exuding wounds e.g., ulcers such as diabetic and leg pressure ulcers.
Algivon®	Calcium alginate and Manuka honey	It eliminates odour and ideal for necrotic wounds and wounds with odours.
Fibracol™Plus	Calcium alginate and collagen	Full and partial-thickness wounds, for ulcers such as pressure ulcers, venous ulcers, diabetic ulcers and second-degree burns.

Commercially Names	Composition	Applications
Hyalogran®	An ester of hyaluronic acid and sodium alginate	Used for ulcers, diabetic wounds, pressure sores, ischemic, necrotic wounds.
Tromboguard®	Sodium alginate, calcium alginate, chitosan, polyurethane and silver cations	Used to stop bleeding in postoperative wounds, traumatic wounds, gun shots, skin graft donor sites, bleeding from accidents.

(Source: Home Medical Supplies)

Figure 12: MAXORB AG+ CMC / Alginate Dressings

c) Secondary Wound Dressings

i. *Absorbents*

Surgical Cotton: Cotton is the basic surgical absorbent. It is official Purified Cotton USP.

Domestic cotton developed in the Southern US is appropriate for careful purposes. The tamed cotton plant achieves a tallness of 2 to 4 ft. Developing from the seeds is a case or boll that blasts open after maturing, uncovering a mass of white cotton strands. Every one of these filaments is a moment, hair-like cylinder, the external divider being unadulterated cellulose, the opening loaded up with plant liquids. At the point when the boll blasts open, the fiber falls into a level strip like structure, turned and multiplied upon itself in excess of multiple times from start to finish. Citrus extract can be utilized both for the expendable (non-sturdy) materials (outfits, veils, and sleeves for circulatory strain estimation) and the materials that expect solidness to washing [53,116].

The raw cotton fiber precisely cleaned of soil and checked into layers however not generally treated, has a constrained use for paddings and covers of solid surfaces. This structure is provided under the name nonabsorbent cotton. It additionally is utilized as often as possible as cotton connects the bacteriological research center on account of its non-retentiveness [117].

*Absorbent Cotton*is set up from the crude fiber by a progression of procedures that expel the regular waxes and all debasements and outside substances and render the filaments permeable. It is a for all intents and purposes unadulterated, white cellulose fiber. Other than the recognizable move structure, Purified Cotton might be gotten in different arranged structures, for example, cotton balls or cotton-tipped tools [117]. Ongoing examinations have appeared perpetual wounds contain elevated amounts of tissue and cytokine devastating proteases including collagenase and neutrophil elastase. The decrease in catalyst action with dialdehyde cotton dressing was affirmed in arrangement by deciding elastase restraint with dialdehyde starch. The dialdehyde cotton dressing likewise diminished elastase action in human wound liquid in a portion reaction connection dependent on weight of bandage per volume of wound liquid [118]. Retentive cotton shows brilliant dampness engrossing and water-holding properties, and ingested particles can be effectively caught among AC strands without delivering gravity water. Notwithstanding, fine filaments are inclined to stay in the wounds even after evacuation [119].

Absorbent balls made of a uniform careful gooey rayon fiber likewise are accessible. These assimilate liquids quicker and hold their shape superior to anything cotton balls. Nonabsorbent Bleached Cotton, arranged by an altered fading process that holds the water-repellent regular oils and waxes, additionally is accessible. This cotton is distinguished effectively by its luxurious feel. Since it is repellent to water, it doesn't end up tangled or inelastic. Subsequently, it is well-adjusted to pressing, cushioning, and padding of dressings over damaged

zones and as nonabsorbent sponsorship on clean napkins, joins, and seepage dressings. All around dyed and checked cotton having receptiveness at the very least 12 hours is utilized in pharmaceutical, keeping up aseptic conditions for assembling process and furthermore for pressing purposes. Non-spongy blanched cotton has water repellant properties on the grounds that while purging off filaments the common wax is held [63], [120-121].

Rayon, or recovered cellulose, is produced using wood or cotton linters. Subsequent to dissolving it in a blend of salt and carbon disulfide, cellulose string is reprecipitated in a corrosive coagulating shower by section through fine openings in a metal plate. Since plant lignins have been expelled, just as the more round cross area, rayon strands are milder and more brilliant than cotton [57-62].

ii. *Surgical Gauzes*

The capacity of careful cloth is to give a permeable material of adequate elasticity for careful dressings. It is known as Absorbent Gauze USP. During the time spent making careful bandage, the crude cotton fiber is cleaned precisely and after that spun or wound into a string, and the string thus is woven into an open-work fabric that is dark and nonabsorbent. It is faded white and offered permeable by much indistinguishable procedures from those utilized in the availability of careful cotton [63]. The bandage in this way treated is dried by passing a constant length through a tentering machine. Tenterhooks rectify, stretch, and hold it tight as it is dried. When it leaves this hardware, the dried bandage is cut into lengths, collapsed, rolled, and stuffed. Bandage is grouped by its work, or number of strings per inch [57, 122]. A few sorts of careful dressing require a nearby coincided bandage for additional quality and more noteworthy security, while different uses, for example, essential wound dressings, retentive optional dressings, and bigger dressings to retain purulent issue or other seepage require gentler, progressively permeable clothes with an increasingly open structure. Different types of cushions, packs, and dressings are produced using careful bandage, alone or in association proportional with retentive cotton, tissue paper, and different materials [63, 57].

Filmated Gauze is a collapsed retentive bandage with a slender, even film of cotton or rayon appropriated over each layer [124]. This filmation cushions up and gives plentiful dressing volume, yet costs not as much as cloth alone of equal volume. It has snappy ingestion and unordinary non-abrasiveness [57]. Head recorded swabs are intended for use on surface wounds and cuts. These swabs are a multi-layer non-woven Polyester/Viscose, which sandwiches caught cotton fiber focuses, giving improved retention [117, 126].

Nonwoven Surgical Sponges—Nonwoven textures have been built up that are reasonable options in contrast to woven cotton bandage for use in wound cleaning, wound dressing, and tissue-taking care of. These nonwoven textures rely upon thick snare of their manufactured strands (Dacron, rayon, and so forth) to give the texture an adequate elasticity moving toward that of woven cotton dressing. They ordinarily offer more prominent permeable limit than cotton dressing wipes of practically identical mass, while creating less build up. Claim to fame adaptations of the nonwoven wipes are accessible pre-fenestrated for IV tubing or channel dressing techniques [127]. One maker (Johnson and Johnson) gives both a nonwoven wipe to wound dressing (Sof-Wick: delicate surface, exceptionally permeable or Topper: exceedingly spongy, less dressing changes) and a nonwoven broadly useful purging/prep wipe (Nu Gauze: cloth like surface, more retentive than bandage) [128]. Furthermore, another general wipe which consolidates the best properties of woven and nonwoven dressing, has been made from another texture innovation. Mirasorb (Johnson and Johnson) is produced using a cotton mix, is more retentive and versatile than woven bandage, gives less adherence to solid tissue, and diminishes wound harm and tissue injury upon expulsion. Cotton balls and careful bandages (CSG) have been routinely utilized for cleaning liquids and blood in medical procedures. Polyurethane sheets (PUS) are progressively utilized rather than CSG [57], [63], [129].

Selvage-Edge Gauze Strips in widths of 1/4 to 2 inches are planned uncommonly and woven for utilize both as pressing strips in medical procedure of the nose and sinuses, nasal hemostasis, and so on, and as seepage wicks in the treatment of bubbles, abscesses, fistulas, and other depleting wounds. The ravel-verification, selvage edges on the two sides take out every single free string. These dressings are accessible unmedicated or sedated with 5% iodoform. These strips are realistic in sterile structure stuffed in fixed glass containers. Nu Gauze Packing Strips are bundled in polystyrene holders [127, 129].

Gauze Pads or Sponges are collapsed squares of careful cloth. These are folded to the point that no cut dressing edges or free strings are uncovered. This keeps free strands from entering the wound. The cushions are collapsed to such an extent that each size might be unfurled to bigger sizes without uncovering cut edges or free strings. Cleaned bundles of these much of the time utilized allgauze wipes are accessible in carefully designed bundles [57, 90]. Such sterile units especially are appropriate to the various plate sets arranged in medical clinics. Bandage cushions and cloth wipes are utilized in various applications and are incredible for general cleaning, dressings, preparing, pressing and debriding wounds. It can likewise be utilized as a transitory retentive dressing over wounds.

The contrast between these things are that cloth cushions accompanied one for each pack, while dressing wipes accompany at least two for every pack [130, 131].

X-ray Detectable Gauze Pads are same as all-cloth cushions yet contain additions treated with barium sulfate. Wipes utilized in medical procedure can be in charge of genuine inconvenience or even passing when they are not effectively distinguished and evacuated [133]. They are nontoxic, delicate, and nonabrasive. They remain for all time perceivable in light of the fact that they neither disintegrate in the body nor are influenced by either disinfection or time [63,136]. Instances of X-beam perceivable wipes incorporate Vistec and Kerlix (interesting, crinkleweave, delicate, and spongy), both made by Kendall [135]. X-Ray Detectable Sterile Gauze Sponges are prudent, multi-reason cloth wipes perfect for use in surgeries. They are sterile, very spongy, and their x-beam perceivability redresses inadvertent maintenance (gossypiboma) in patients. Exceptionally retentive (16-handle), fine work 100% cotton dressing is for all intents and purposes build up free. Latex free [134].

Ray-Tec X-Ray Detectable Sponges (Johnson & Johnson) contain a nonabrasive vinyl plastic monofilament that gives a trademark design in the X-beam. Composite permeable dressings have been progressed for explicit purposes. They normally comprise of layers of spongy dressing or nonwoven texture with fillers of cotton, rayon, nonwoven texture, or tissue paper in reasonable game plans. Composite wipes have dressing or nonwoven texture surfaces with fillers of cotton, rayon, nonwoven texture, or retentive tissue [63-70]. The RAY-TEC X-Rayable Sponge removed the mystery from careful accidents. On the off chance that a careful wipe was unintentionally left in a body during an activity, it could now be effectively identified by a x-beam. The spearheading wipes spared patients from conceivable exploratory medical procedure or extra pointless treatment following entanglements [136, 137].

iii. *Dressing Combines*

Dressing Combines are intended to give warmth and insurance and to assimilate enormous amounts of liquid that may deplete from an entry point or wound. Each consolidate comprises of a nonwoven texture spread encasing fiber with or without spongy tissue. They additionally may fuse a nonabsorbent layer of cotton, tissue, or plastic film to keep liquid from coming through to soil liners and bedding, however some consolidated dressings are altogether spongy [138,139]. Exorbitant draining is a confusion of wound debridement in patients accepting anticoagulation treatment. Chitosan is a straight, decidedly charged polysaccharide that has potential as a hemostatic topical dressing. Topical use of Opticell dressing with chitosan has hemostatic impacts that could be a valuable device to control draining related with wound debridement [139, 140]. Drawn out essential anticoagulation could impede the healing procedure. A minor wound could be a day by day challenge for patients who use anticoagulants and antiplatelet drugs. Standard cloth dressings and direct pressure are regularly time-concentrated for controlling discharge for these patients [140]. In particular, the composites are antibacterial, hemostatic, biocompatible, great permeable for anticoagulated entire blood, and can keep up dampness balance for wound healing. For instance, the composites were found to hinder the development of both Gram positive and negative smaller scale life forms (counting Escherichia coli (ATCC 8739), Staphylococcus aureus (ATCC 25923), methicillin safe S. aureus (ATCC 33591), and vancomycin safe Enterococcus faecalis (ATCC 51299). They are nontoxic to fibroblasts, in particular fibroblasts were found to develop and multiply within the sight of the composites [141].

iv. *Laparotomy Sponges*

Laparotomy Sponges, otherwise called Abdominal Packs, Tape Pads or Packs, Walling-Off Mops, Stitched Pads, Quilted Pads, Gauze Mops, and so forth, are utilized to shape a nonabrasive divider that will block stomach or different organs from going into the field of activity and to help bolster body temperature during presentation. The employable control of non-compressible discharge is the single biggest effect that could be tended to in decreasing the mortality on the combat zone. Laprotomy cushions, generally utilized for drain clearing, are made of woven cotton, and, while compelling, their utilization requires a significant measure of room and includes weight. This represents no worry in conventional working rooms however is a deterrent for portable suppliers and suppliers in somber situations [142]. Be that as it may, wipes are made of four layers of 28×24 work dressing. The edges are collapsed in and trimmed. The whole pack is cross-sewed, and a circled tape 1/2-inch wide and 20-inches in length is connected to one corner. An alluring element of one sort is a X-beam perceptible addition so immovably fused into the bandage that it can't end up disconnected. Treated with barium sulfate, the monofilament is nontoxic and, were it to be left coincidentally in situ, would cause not any more outside body response than a conventional dressing [54].

v. *Sanitary Napkins*

Sanitary Napkins proposed for unique medical clinic use, also called V-Pads, Obstetrical (OB) Pads, Perineal Pads, Maternity Pads, and so on, are utilized in obstetrical, gynecological, or maternity cases. Napkins that have repellent tissue as an afterthought and back surfaces of the napkin for the most part are favored in light of their more noteworthy liquid holding limit. Clean

napkins for the most part accompany two sizes of filler, 3×9-inch or 3×11-inch. The napkin spread by and large is produced using a nonwoven texture or a nonwoven texture bolstered with an open-work scrim. Bundled, sanitized napkins are accessible and utilized by and large to decrease cross-pollution conceivable outcomes. lessening mental worry during the feminine cycle time frame is a significant personal satisfaction issue for ladies. Wearing a sterile napkin (SN) is accepted to impact mental pressure reactions of ladies during everyday living exercises [54], [71,72].

vi. *Disposable Cleaners*

Disposable Cleaners made from various types of nonwoven fabrics are available. They generally offer advantages over paper in wet strength and abrasion resistance, plus having better cleaning ability. Their advantages over cloth are reduced laundry expense and cross-contamination possibilities.

vii. *Eye Pads*

Eye Pads are experimentally molded to fit easily and spread the eye totally, accordingly securing the eyebrow when taped. These cushions are made utilizing nonwoven texture. Eye patches are commonly utilized post eye medical procedure, during the evening so as to ensure the eye and lessen inconvenience. It might possibly be utilized during the day. The Eyelid must be shut before use of the fix. An appropriately set fix must apply delicate pressure on the eye cover to stay shut and the eye itself does not rub against the fix. Since the measure of light going into the eye diminishes it helps in facilitating the inconvenience. The eye can at present move under the fix. At times if the careful wound isn't appropriately fixed, an extra day of fixing may be required. In progressively extreme cases patient may need to get the wound re-worked for appropriate conclusion. Eye patches are favored as they help in restricting the swelling. It is prudent to evacuate eye patches at whatever point conceivable to permit healing and utmost the dampness inside the fix which can likewise now and then be unsafe. Different sides are encased to keep the cotton from getting away and the cushion from contorting. Whenever wanted, the cushion might be collapsed and utilized as a pressure dressing. Eye cushions particularly are helpful in the outpatient facility of the emergency clinic, the modern therapeutic office, and the doctor's office. They are fixed in individual sterile envelopes [143-146].

viii. *Nursing Pads*

Nursing Pads are designed in a contour shape to fit comfortably under the nursing brassiere or breast binder.

ix. *Disposable Under-pads*

Disposable Under-pads are utilized for incontinent, maternity, and different patients with serious seepage. Such cushions cost not exactly the normal clinic made item and give a slick, spotless, simple to-deal with cushion that is changed rapidly and effectively arranged [150]. The development of an underpad ought to achieve three objectives. In the first place, its sponsorship ought to have a low coefficient of grinding to counteract frictional skin wounds. Second, an internal retentive center ought to quickly contain dampness and scatter it all through the whole cushion. Third, the center and cover stock ought to effectively cooperate to hold dampness and forestall wet-back or liquid return [152]. Expendable briefs are accessible (Johnson and Johnson, Kendall). Incontinence items can be tremendously useful. They can counteract spilling onto your garments, control smell, and avoid skin disturbance [150]. Utilization of dispensable incontinence cushions diminishes medical clinic obtained pressure wounds (HAPIs) however not incontinence-related dermatitis (IAD) events [151]. Peacefulness Peach Sheet underpad can contain well more than one quart of liquid. This item accommodates excellent skin dryness, smell disposal, bacterial control and pH balance. Four sticky tape tabs secure the situating of about 5 square feet of insurance to wheelchairs, bedding and furniture. Perfect for the individuals who are in danger of skin breakdown, because of delicate skin or abnormal amounts of pee misfortune [152]. It was observed to be extremely cost effective, on the grounds that the Tuckable could stay set up over seven days without evolving [151].

x. *Cotton-Tipped Applicators*

Cotton-Tipped Applicators are used to apply medications or cleanse an area. Makes it easy to clean/culture hard to reach areas. Machine-made cotton-tipped applicators are uniform in size, resulting in no waste of cotton or medications [153].The cotton is attached firmly to the stick and may be sterilized readily without affecting the anchorage of the cotton. They are available in 3- or 6-inch lengths [73].

d) Bandages

The function of bandages is to hold dressings in place by providing pressure or support. They may be inelastic, be elastic, or become rigid after shaping for immobilization. Common Gauze

i. *Roller Bandage*

Roller Bandage is listed in the USP as a form in which Absorbent Gauze may be provided. It is prepared from Type I Absorbent Gauze in various widths and lengths. Each bandage is in one continuous piece, tightly rolled and substantially free from loose threads and raveling's.

ii. *Muslin Bandage Rolls*

Muslin Bandage Rolls are made of heavier unbleached material (56 ×60 mesh). They are provided in the same widths as the typical gauze bandage. Muslin bandages are very strong and are used wherever gauze bandages do not provide sufficient strength or

support. They frequently are used to hold splints or bulky compression dressings in place [54, 57, 63].

iii. *Elastic Bandages are made in several types*

A. *Woven Elastic Bandage* is made of heavy elastic webbing containing rubber threads. Good support and pressure are provided by this type of rubber elastic bandage [147].

B. *Crepe Bandage* is elastic but contains no rubber. Its elasticity is owing to a particular weave that allows it to stretch to practically twice its length, even after repeated cleansings. This elasticity makes it especially serviceable in bandaging varicose veins, sprains, etc, because it conforms closely to the skin or joint surfaces, lies flat and secure, yet allows limited motion and stretches in case of swelling so that circulation is not impaired [148].

C. *Conforming Bandage* is produced using two handles of exceptionally prepared, high caliber, 14× 8-inch cotton cloth collapsed to the middle. This sort is a lot simpler to utilize and apply than standard roller swathe, since it will in general stick to itself during application, subsequently averting slipping. It promptly adjusts to all body designs without the need of turning around or contorting. A further bit of leeway is the way that there can be no unpleasant or frayed edge. Kling Conforming Gauze Bandage and Sof-King Conforming Bandage (Johnson and Johnson) are accessible in an assortment of sizes up to 6 inches wide. This bandage is utilized generally to hold dressings or supports solidly set up and once in a while as an essential dressing when adhering to the wound isn't an issue. A mercerized cotton Conforming Gauze Bandage sticks to itself and accordingly stays set up superior to anything dressing made of different materials. Sof-King is a one-utilize rayon and polyester mix wrap that gives more prominent mass to padding and more noteworthy retentiveness [20],[149], [63], [154].

D. *High-Bulk Bandage* is made of multiple layers (typically six) of crimped cotton gauze. The high bulk of this bandage type is designed to provide padding protection in wound dressing applications. It also provides the absorbent capacity of a cotton dressing component [155]. One version (Sof-Band High Bulk, Johnson & Johnson) is made of mercerized cotton to help the bandage cling to itself, which facilitates application and improves dressing stability.

E. *Compression Bandage* is made out of cotton weaved or woven with either thick, polyurethane, nylon, or elastane strings. Otherwise called flexible gauzes, are regularly utilized for the pressure some portion of RICE—Rest, Ice, Compression and Elevation—the best quality level of medical aid treatment for wounds and sprains. Likely the most well-known brand name for a flexible swathe is an Ace wrap [156]. The wrap is agreeable and simple to apply. Its utilization is basically to keep up controlled degrees of pressure when pressure treatment is required. Similarly as with all pressure gauzes, these items ought to be used with alert on patients with stamped fringe ischemia or weakened blood vessel blood supply. Instances of pressure gauze incorporate Tensopress (Smith and Nephew), Yeinopress (Moliner), and Setopress (Seton Healthcare) [157].

iv. *Triangular Bandages*

Triangular Bandages usually are made by cutting a square of bleached muslin diagonally from corner to corner, forming two right triangles of equal size and shape. The length of the base is approximately 54 inches. These bandages were brought into prominence by Esmarch and still bear his name. They are used in first-aid work for head dressings, binders, and arm slings and as temporary splints for broken bones. A triangular bandage is used as an arm sling or as a pad to control bleeding. It may also be used to support or immobilize an injury to a bone or joint or as improvised padding over a painful injury. A tubular gauze bandage is used to retain a dressing on a finger or toe [158,159].

v. *Orthopedic Bandages*

Orthopedic Bandages are utilized to give immobilization and backing in the treatment of broken bones and in specific states of bones and joints. Mortar of Paris–impregnated dressing has been the ordinary material for this reason. All the more as of late presented are manufactured cast materials made of polyester cotton or fiberglass. Different sorts of plastic sheets likewise are offered that can be molded effectively and solidified to an unbending structure by cooling or substance response. These are valuable essentially for supports and restorative props. Separately bundled mortar of Paris wraps and braces are accessible in a wide assortment of sizes [53]. Flexible gauzes are regularly utilized in games to treat and anticipate sport wounds [162]. The Specialist brand (Johnson and Johnson) is produced using exceptionally treated mortar, consistently spread and solidly clung to the texture. This outcomes in a high solidarity to-weight proportion in throws produced using such gauzes. Engineered throws are connected like mortar of Paris. The utilization of an inelastic, short-extend pressure gauze following all out knee arthroplasty is a sheltered strategy that is satisfactory to patients [163]. The Delta-Lite Synthetic Casting System (Johnson and Johnson) offers both polyester, cotton texture impregnated with a polyurethane tar, and fiberglass throwing materials. Scotch cast Soft cast (3M) comprises of a sewed fiberglass substrate impregnated with a polyurethane tar containing a surface changing specialist (lessen tack, encourage application) [160]. The throws are water-

safe, light weight, and tough. Delicate, smooth and comparable to the body's shape. It is tear capable and quill capable, has low dampness maintenance, and is permeable enough to permit air course and to diminish skin disturbance. It very well may be utilized under a wide range of throwing materials, giving compelling, agreeable and safe throwing [161].

vi. *Orthoflex Elastic Plaster Bandages (Johnson & Johnson)*

Orthoflex Elastic Plaster Bandages (Johnson & Johnson) are plaster of Paris bandages containing elastic threads in the fabric and are intended for specialized prosthetic uses. Stockinette Bandages are made of stockinette material knitted or woven in tubular form without seams. Surgical stockinette is unbleached. Because it is soft and will stretch readily to conform comfortably to the arm, leg, or body, it is used to cover the skin prior to the application of a plaster of Paris or synthetic cast [165,166]. The physical properties of plaster bandages are a very important factor in achieving the basic functions of immobilization (maintaining bone fragments in the best possible position), which directly affects the speed and quality of fracture healing [164].

vii. *Cast Paddings*

Cast Paddings are soft, absorbent, protective paddings, applied like a bandage to the areas affected, before application of a cast. They are composed of various fiber constructions that conform and cling, absorb moisture, and allow the skin to breathe [74-80].

e) Adhesive Tapes

Surgical adhesive tapes are made in many different forms, varying both in the type of backing and in the formulation of theadhesive mass according to specific needs and requirements. The tapes available today may be divided into two broad categories: those with a rubber-based adhesive and those with anacrylate adhesive. Both types have a variety of uses. When strength of backing, superior adhesion, and economy are required (eg, athletic strapping), rubber adhesives commonly are used. Acrylate adhesives on a variety of backing materials are used widely in surgical dressing applications, when reduced skin trauma is required, as in operative and postoperative procedures; they are supplied in various strength and adhesion levels [81-85].

i. *Acrylate Adhesives*

Acrylate glues on a nonwoven or texture support have been acknowledged generally for use as careful tapes, owing to a great extent to what might be named their hypoallergenic nature. Since acrylate glues are essentially a uni-polymeric framework, they wipe out the utilization of an enormous number of segments in elastic based cements. In poly (alkyl-acrylate) cements, the ideal harmony between attachment, union, and stream properties is dictated by the selection of monomers and the control of the polymerization responses. When the polymer is made, no other detailing or intensifying is required. Moreover, the acrylics have a phenomenal timeframe of realistic usability since they are not influenced promptly by warmth, light, or air, factors that will in general debase elastic based cements. Acrylate glues consolidate the correct parity of tack and long haul attachment. Their atomic structure allows the entry of water vapor so they are nonocclusive and along these lines when covered on a permeable sponsorship material don't cause over hydration in the stratum corneum. Horrendous reaction to careful tapes is limited significantly when tapes are developed to enable typical skin dampness to go through glue and support material. With this development, the dampness substance and quality of the horny cell layers remain generally ordinary. At the point when a permeable tape is evacuated, the planes of detachment create close to the outside of the stratum corneum, in the area of the normally desquamating cells. This permits rehashed utilization of tape over a similar site with insignificant harm to the skin. Hypoallergenic Surgical Tapes with acrylate cement are accessible with an assortment of permeable support materials. Rayon fabric material sponsorship gives a high-quality tape appropriate for fastening substantial dressings. Lighter dressing applications can be practiced with lower-quality, efficient, paperbacked careful tapes. A weaved sponsorship tape (Dermiform, Johnson and Johnson) gives a portion of the economies of paper careful tape with the quality and likeness of a material support. Different tapes include versatile fabric or froth backing materials for unique taping needs [169].

ii. *Rubber-Based Adhesives*

A second group of surgical adhesive tapes is the cloth-backed and plastic-backed rubber adhesives. These are used primarily where heavy support and a high level of adhesion are required. Modern rubber-based adhesive tape masses consist of varying mixtures of several classes of substances and are composed of an elastomer (para or pale crepe rubber in the case of natural rubber tapes, and synthetic elastomers made from polymers of isobutylene, alkyl-acrylate, or similar materials), one of several types of rosin or modified rosin, antioxidants, plasticizers and fillers, and coloring agents to give the tape the desired tint or whiteness [170].

Adhesive Tape Reactions: While skin responses some time ago were acknowledged by the medicinal calling as practically unsurprising sequelae to the utilization of sticky tape, with better comprehension of the components of such responses and advancement in research and innovation, the long-looked for target of hypo-reactivity has, in huge degree, been accomplished. Since sticky tape masses generally have comprised of heterogeneous and complex blends of

natural mixes, it isn't astounding that numerous specialists have credited sticky tape response to sensitivity. Later work, be that as it may, has demonstrated that a genuine hypersensitive reaction to the advanced sticky tape mass or its segments is a factor in just a little extent of clinical responses and that most watched responses are credited appropriately to different components, primarily mechanical disturbance and, to a lesser degree, concoction aggravation. There clearly is no critical distinction in response between patients with or without a background marked by hypersensitivity, however obvious explicit dermatitis may happen all the more promptly in people who have showed some other type of contact dermatitis. Unfriendly indications delivered by sticky tape are described by erythema, edema, papules, vesicles, and in extreme cases, desquamation. Tingling might be extraordinary, or it might be missing. The response might be exhibited promptly by patchtesting, and more often than not shows itself ahead of schedule—inside 24 to 48 hr. Typically, the response turns out to be increasingly serious the more drawn out the tape is left set up and keeps on expanding in force for quite a while after the tape is evacuated. This kind of response is durable and requires days for its total subsidence. Two particular sorts of bothering can result from the mechanical elements of expelling tape from the skin. One reaction—actuated vasodilation—is a generally nontraumatic, fleeting impact in which no genuine harm to the skin happens. A subsequent sort—skin stripping—is an awful reaction in which skin is evacuated with the tape and real harm to the epidermal layers results. Such mechanical skin evacuation is potentially the prevailing reason for clinical responses seen with the utilization of sticky tape. Substance bothering from sticky tape results when disturbing parts in the mass or sponsorship of the tape pervade the fundamental tissues of the skin. The tape development can impact the reactivity of such fixings considerably. For instance, numerous exacerbates that typically don't enter unblemished stratum corneum can infiltrate overhydrated corneum. At the point when bits of the stratum corneum are evacuated, the hindrance limit of the skin is harmed significantly. In this circumstance, any bothering parts of the tape have prepared access to fundamental tissues. These substances at that point can cause a level of aggravation that is far more prominent than would be seen on unblemished skin [81-85], [171, 172].

f) Protectives

Up to this point, protectives included just the different impermeable materials proposed to be utilized adjunctively with other dressing segments to anticipate the loss of dampness or warmth from a wound site or to shield garments or bed liners from wound exudate. Film dressings are phenomenal gadgets to ensure against infection and dislodgement of vascular cannulae and seepage destinations. Also, they might be utilized to ensure unprotected zones against pressure wounds. Protectives additionally are utilized to cover wet dressings and hot or cold packs. In like manner use as protectives are plastic sheeting and waxed or plastic-covered paper. These anticipate the break of dampness or warmth from the dressing or the pack and secure attire or bed materials. Elastic sheeting is an elastic covered material, waterproof and adaptable, in different lengths and widths for use as a covering for bedding. A purported nursery sheeting is provided, covered distinctly on one side [86-88].

g) Products for Adhesion Prevention

Grips are unusual associations between organs or tissues that structure after injury, including medical procedure. They comprise of deliberate fibrin and fibrovascular scar tissue and convolute all regions of medical procedure. In gynecological medical procedure, bonds may result in barrenness and pelvic agony; in intestinal medical procedure they may result in intestinal hindrance; in cardiovascular medical procedure they may render a second sternotomy perilous, and in ligament medical procedure they will avert versatility. Albeit cautious tissue taking care of and great hemostasis may decrease attachment arrangement, there are not many demonstrated substances intended for the counteractive action of grips. Gynecare Interceed Absorbable Adhesion Barrier (Ethicon) is a sewn texture of oxidized recovered cellulose that is set at a site where bonds are suspected to happen. It swells and gels to frame a boundary between two adjoining surfaces, permitting re-mesothelialization to occur. The texture at that point debases horribly by around 14 days and infinitesimally by around 28 days. Interceed Barrier is shown for diminishing the occurrence of bonds in pelvic gynecological medical procedure. Other mechanical hindrances utilized for the avoidance of bonds incorporate Seprafilm (Genzyme) and Gore-Tex Surgical Membrane (Gore). More up to date items accessible for the counteractive action of postoperative bonds that are not site-explicit for application incorporate Gynecare Intergel Adhesion Prevention Solution, a ferric hyaluronate gel (Lifecore Biomedical) and Sepracoat, a weaken hyaluronic corrosive arrangement(Genzyme) [89, 90], [173,174].

h) Operating Room Supplies

i. *Hemostatic Products*

Hemostatic Products quicken hemostasis by giving a thrombogenic surface that advances platelet accumulation and fibrin polymerization. These topical hemostatic operators incorporate collagen, gelatin, cellulose, and thrombin. These incorporate collagen wipes and powders (Instat, Johnson and Johnson; Helistat, Integra Life Sciences; Actiofoam, Bard; Avitene, Davol; Helitene, Integra Life Sciences), gelatin wipes

(Surgifoam, Johnson and Johnson; Gelfoam, Upjohn), and Oxidized Regenerated Cellulose USP (Surgicel, Johnson and Johnson). Both oxidized cellulose and oxidized recovered cellulose are operators whose activities rely upon the development of a coagulum comprising of salts of polyanhydroglucuronic corrosive and hemoglobin. At the point when connected to a draining surface, they swell to frame a darker coagulated mass that is ingested bit by bit by the tissues, as a rule inside 7 to 14 days. They are utilized in medical procedure for the control of moderate draining when suturing or ligation is unrealistic or ineffectual.

ii. *Thrombin (USP) solutions*

Thrombin (USP) solutions of bovine origin (Thrombinar, Jones Medical) promote hemostasis by catalyzing the conversion of fibrinogen to fibrin. They may be used in conjunction with fibrinogen concentrates prepared from autologous cryoprecipitateor from pooled donor blood.

iii. *Tissue sealants*

Tissue sealants are absorbable and are utilized for an assortment of signs including fixing of blood vessel punctures, fixing of air spills during pneumonic medical procedure, and supporting wound healing. The zone of tissue sealants is extending quickly, with new items achieving the market for various signs. Angio-seal (Kendall), an absorbable material, is utilized as a sealant for blood vessel punctures. AdvaSeal (Focal), an engineered absorbable sealant, is utilized to seal air spills during pneumonic medical procedure. Tissell (Immuno AE), a two-segment fibrin sealant, is utilized to advance wound healing just as accomplish hemostasis and tissue attachment. BioGlue, (Cryolife) is a cow-like egg whites based paste used to seal aortic aneurysms and anastomotic destinations.

iv. *Tissue glues*

Tissue glues are used for topical skin adhesives and replace the need for sutures, staples, or adhesive strips for certain types of lacerations requiring closely approximated wound edges. Derma bond (Closure Medical), an octyl cyanoacrylate, is used as a topical skin adhesive that sloughs from the wound as re-epithelialization of the skin occurs, providing sufficient time for wound healing. Indermil (Tyco Healthcare), a butylcyanoacrylate, is another topical skin adhesive.

v. *Disposable Sterile OR and OB Packs*

Disposable Sterile OR and OB Packs are prepared, packaged, and sterilized assemblies of diapering and gown units, designed to fulfill the operating and delivery room needs. They eliminate the problems of laundering, storage, assembly, and sterilization of muslin drapes and gowns. They introduce many special materials with particular properties of porosity; repellency to water, alcohol, blood and other fluids; abrasion resistance; and other desirable attributes.

vi. *Double packages*

Double packages of contamination-resistant paper have been developed to permit opening and use without compromising sterility. Retention of sterile characteristics until used, eliminates the need for re-sterilization. Face masks for use in the operating room and where contamination must be controlled generally are made of plied, fine-mesh gauze, shaped to cover the nose, mouth, and chin. They are laundered and autoclaved. Disposable face masks with special filtration material giving high retention of particulate matter and designed for more effective fitting are available from several manufacturers. Surgine Face Mask (Johnson & Johnson) claims a 94% filtration efficiency with high user comfort [54], [91], [175-178]

i) Surgical Dressings

i. *Adhesive Bandage*

Adhesive Absorbent Compress; Adhesive Absorbent Gauze: A compress of four layers of Type I absorbent gauze, or other suitable material, affixed to a film or fabric coated with a pressure-sensitive adhesive substance. It is sterile. The compact may contain a appropriate antimicrobial agent and may contain one or more suitable colors. The adhesives Surface is covered by a suitable removable covering.

Description- The compress is substantially free from loose threads or ravelings; the adhesive strip may be perforated, and the back may be coated with a water-repellent film.

ii. *Gauze Bandage*

Type I absorbent gauze; contains no dye or other additives.

Description- One continuous piece, tightly rolled, in various widths and lengths and substantially free from loose threads and ravelings.

iii. *Oxidized Cellulose*

Absorbable Cellulose; Absorbable Cotton; Cellulosic Acid; Hemo-Pak(Johnson & Johnson); Oxycel (Deseret Medical)Sterile gauze or cotton that has been oxidized chemically to make it bothhemostatic and absorbable; contains 16% to 24% carboxyl (COOH) groups.

Description- In the form of gauze or lint. Is slightly off-white in color, is acid to the taste, and has a slight charred odor.

Solubility- Insoluble in water or acids; soluble in dilute alkalies.

Comments- The estimation of oxidized cellulose in different surgeries depends on its properties of absorbability when covered in tissues and its surprising hemostatic impact. Ingestion happens between the second-and seventh-day following implantation of the dry material, contingent upon the sufficiency of the blood provided to the territory and the level of

concoction debasement of the embedded material. Complete retention of a lot of blood-doused dressing may take a month and a half or more, and genuine careful difficulties and sore arrangement have been accounted for as the consequence of inability to assimilate. Hemostasis relies on the stamped fondness of cellulosic corrosive for hemoglobin. At the point when presented to blood, either in vitro or in careful conditions, the oxidized cloth or cotton turns exceptionally dim darker or dark and structures a delicate coagulated mass that promptly shape itself to the forms of unpredictable surfaces and controls careful discharge by giving a falsely actuated cluster. Pressure ought to be applied on the bandage or cotton for around 2 min to encourage the fixing off of little, draining vessels.

Two factors require emphasis:

1. Cellulosic acid does not enter the physiological clotting mechanism per se but forms what might be termedan artificial clot as described and, therefore, is effective in controlling the bleeding hemophiliac and
2. The hemostatic action of cellulosic acid is not enhanced by the addition of other hemostatic agents, such as thrombin (which in any case would be destroyed by the pH of the gauze unless some means of neutralization were practicable). The hemostatic effect of either one alone is greater than the combination.

It is helpful as a transitory pressing for the control of fine, venous, or little blood vessel drain, however since it restrains epithelialization, it ought to be utilized uniquely for the prompt control of discharge and not as a surface dressing. A cleaner and increasingly uniform item arranged from oxidized recovered cellulose has been created and is accessible as Surgicel Absorbable Hemostat. This offers numerous points of interest over the more seasoned, less-uniform oxidized cellulose got from cotton and, due to its compound consistency, guarantees reliable execution and defeats a large number of the challenges experienced with the more established kind of cotton item. The sewed texture strips don't part, might be sutured set up effectively if essential, and furnish instant and complete assimilation with least tissue response.

iv. *Oxidized Regenerated Cellulose*

Surgicel; Surgicel Nu-Knit; Surgicel Fibrillar (Johnson & Johnson)

Contains 18–24% carboxyl groups (COOH), calculated on the dried basis. It is sterile.

Preparation- Cellulose is dissolved and regenerated by a process similar to the manufacture of rayon, which is then oxidized.

Description- Creamy white gauze, lint, or woven material.

Solubility- Insoluble in water; soluble in alkali hydroxides.

Comments- Absorbable hemostatic.

v. *Purified cotton*

Gossypium Purificatum; Absorbent Cotton

The hair of the seed of cultivated varieties of Gossypium hirsutum Linnéor other species of Gossypium (Fam Malvaceae), freed from adhering impurities, deprived of fatty matter, bleached, and sterilized in its final container.

Description- White, soft, fine, filament-like hairs appearing under the microscope as hollow, flattened and twisted bands, striate and slightly thickened at the edges; practically odorless and practically tasteless.

Solubility- Insoluble in ordinary solvents; soluble in ammoniatedcupric oxide TS.

vi. *Dextranomer*

Debrisan (Johnson & Johnson)

Dextranomer is a three-dimensional cross-linked dextran polymer preparedby interaction of dextran with epichlorohydrin.

Description- White, spherical beads, 0.1 to 0.3 mm in diameter; hydrophilic. Also available dispersed in polyethylene glycol, as a paste.

Solubility- Insoluble in water or alcohol. Each gram absorbs about4 mL of aqueous fluid, the beads swelling and forming a gel.

Comments- Topically to cleanse secreting lesions such as venousstasis ulcers, decubitus ulcers, infected traumatic and surgical wounds, and infected burns. It absorbs the exudates, including the components that tend to impede tissue repair, and thereby retards eschar formation and keeps lesions soft and pliable.

vii. *Absorbable Dusting Powder*

Starch-derivative Dusting Powder

An absorbable powder prepared by processing cornstarch and intended for use as a lubricant for surgical gloves; contains not more than 2% magnesium oxide.

Description- White, odorless powder; pH (1 in 10 suspension) between10 and 10.8.

viii. *Absorbent Gauze*

Carbasus Absorbens; Gauze

Cotton, or a mixture of cotton and not more than 53.0%, by weight, of purified rayon, in the form of a plain-woven cloth. If rendered sterile, it is packaged to protect it from contamination. Description—White cotton cloth of various thread counts and weights; may be supplied in various lengths and widths and in the form of rolls or folds.

ix. *Purified Rayon*

A fibrous form of bleached, regenerated cellulose. It may contain no more than 1.25% titanium dioxide.

Preparation- By the viscose rayon process.

Description- White, lustrous or dull, fine, soft, filamentous fibers, appearing under the microscope as round, oval, or slightly flattened translucent rods, straight or crimped, striate and with serrate cross-sectional edges; practically odorless and practically tasteless.

Solubility- Very soluble in ammoniated cupric oxide TS or dilute H_2SO_4 (3 in 5); insoluble in ordinary solvents.
Comments- Hemostatic.

x. *Adhesive Tape*

Sterile Adhesive Tape

Fabric and/or film evenly coated on one side with a pressure-sensitive, adhesive mixture. If rendered sterile, it is protected from contamination by appropriate packaging [20], [25], [57], [63], [66], [74], [92-97].

IV. Pharmacist's Role

In customary practice, it is frequently during these far reaching prescription audits that a drug specialist should ready to evaluate the patient's hazard factors for wounds and note any early indications of venous trade off. Network pharmacists are regularly in contact with the patient or patient's delegate every now and again as the patient will in general come back to the drug store a few times each month for an assortment of human services needs. The most evident commitment of a network drug specialist would be in the administration of neighborhood wound consideration, explicitly the administration of aggravation and infection control. Numerous anti-infection agents will meddle with different prescriptions, including over-the-counter drugs. For instance, fluoroquinolones, for example, ciprofloxacin, will tie to calcium, magnesium and iron in the gastrointestinal framework and diminish the assimilation and adequacy of the anti-microbial. Pharmacists need to encourage patients to stop their multi-nutrients and additionally acid neutralizers when taking fluoroquinolones, or to take the items at isolated occasions of the day. Once more, high portions of anti-toxins may cause gastric aggravation, could be avoided by PPIs. By perceiving venous skin changes (for instance), realizing when to allude patients to their essential consideration suppliers and perceiving the patient's status to change, pharmacists can assume an indispensable job in supporting the convenient survey and reassessment of wounds. The needs (and the board plans) of the patient can change quickly and definitely, especially in the perplexing instance of wounds where there are a few simultaneous co-sullen conditions. The avoidance and treatment of wounds is mind boggling, regularly multi-factorial in starting point and best polished through a composed, inter-professional group approach. This work together tie approach postures difficulties, for example, encouraging correspondence when colleagues are physically situated in discrete workplaces and work various hours [98,99], [179-182]. For quick reference, a quick wound care chart is detailed in Table 2 and barriers to effective wound care in Table 3.

Table 2: Quick Reference Wound Care Chart [100]

Dressing Type	Wound Type	When to change dressing	Comments/Expectations
Paraffin dressings • Cuticerin • Jelonet • Bactigras	• Superficial, clean, minor abrasions • Skin tears that require review within 24 to 48 hours	• 2 days	• Prevent maceration • Granulation • Protect epithelizing wound
Long wearing impregnated mesh • Mepitel (silicone)	• Epidermal and clean superficial dermal • Epithelised burns	• 7 days	• Healing • Epithelization
Absorbent Pads • Mesasorb • Zetuvit	• Oozing wounds • Secondary dressing to absorb exudate	• PRN • 3 days	• Absorb fluid • Prevent maceration
Films • Tegaderm Opsite	• Secondary dressing for burns and sutures • Stage I pressure injuries	• 2 to 7 days "A week or a leak"	• Not to be used on infected wounds • Keep dressings intact • Keep dressings dry • Water resistant not waterproof • Protect against sheer and friction
Foams • Allevyn Lyofoam	• Pressure injuries • Ulcers Toe wounds	• 2 to 5 days When exudate is 1 cm from the edge of dressing	• Protection • Draws fluid from wound preventing maceration and promoting healing

Soft silicone • Mepilex border	• Skin tears • Epithelising wounds • Superficial dermal burns • Epithelized burns	• 2 to 7 days (depending on skin tear)	• Healing • Protect epithelializing tissue • Prevent maceration • Ensure hemostasis prior
Hydrocolloids • Duoderm • Duoderm extra thin Comfeel	• Stage I pressure injuries • Superficial dermal burns	• 2 to 5 days Change if leakage occurs or rolled up	• For wounds with minimal exudate • Prevent maceration • Protection
Hydrocolloid paste • Comfeel paste	• Pressure injuries with slough • Ulcers with slough	• 2 days	• De-slough • Re-hydrate • Fills dead space
Hydrogels • Solugel • Intrasite gel • Purilon	• Necrotic ulcers • Pressure injuries with slough	• Daily to 2 days	• Rehydrate • De-slough • Prevent maceration
Calcium Alginate • Kaltostat Kaltostat rope	• Promote haemostasis • Bleeding ulcers • Bleeding skin tears • Around bleeding insertion sites	• 24 hours (until haemostasis is achieved)	• Prevent trauma (soak off if stuck to wound) • Haemostasis • Absorption (absorbs up to 20 times its weight in fluid) • Granulation
Hydrofibre • Aquacel Durofibre	• Moderately to heavily exudating wounds • Not bleeding wounds	• 2nd to 3rd daily	• Prevent maceration • Maintain a moist wound environment
Cadexomer Iodine • Iodosorb	• Heavily colonised infected wounds • Infected or slow to progress wounds	• 2nd to 3rd daily In severe cases may need to be dressed daily	• Check for iodine/shellfish sensitivities • Change to paste when powder begins to crust up • Remove all product before reapplication • Can be painful on application

V. Factors Delaying Wound Healing

Holistic assessment of the patient is an important part of the wound care process. A number of local and systemic factors can delay or impair wound healing. These may include:

- *Malnutrition:* Inadequate supply of protein, carbohydrates, fatty acids, and trace elements essential for all phases of wound healing
- *Reduced Blood supply:* Cardiovascular disorders and Ischemia
- *Medication:* Non-steroidal anti-inflammatory drugs and Corticosteroids.
- *Chemotherapy:* Suppresses the immune system and inflammatory response
- *Radiotherapy:* Increases production of free radical which damage cells
- *Psychological stress and lack of sleep:* Increase risk of infection and delayed healing
- *Obesity :* Decreases tissue perfusion
- *Infection:* Prolong inflammatory phase, use vital nutrients, impair epithelialization and release toxins
- *Reduced wound temperature:* Prolonged dressing changes or use of cold cleansing products.
- *Underlying Disease:* Diabetes Mellitus and Autoimmune disorders
- *Maceration:* Excess wound exudates or contact with bodily fluids reduces wound tensile strength
- Inappropriate wound management
- Patient compliance
- Unrelieved pressure
- Immobility
- Substance abuse including alcohol and cigarette smoke [101], [111-115]

Table 3: Barriers to effective treatment of wounds [109]

Barriers	Examples
Educational factor	Poor quality of research, lack of appropriate training, ritualistic practice and lack of appropriate skills.
Organizational factor	Lack of standardisation of practice that is acceptable, lack of expert opinion, instability in the health services.
Clinical factor	Bacterial infection, hypersensitivity,

Barriers	Examples
	malnutrition, poor tissue perfusion, copious exudate, too much or too little information on wound management.
Psychosocial factor	Social isolation resulting in depression and reduced motivation with treatment, pain resulting in loss of sufficient sleep and lack of self-care.

VI. Future directions

The improvement of new and compelling intercessions in wound consideration remains a zone of exceptional research. Negative pressure wound treatment has without a doubt changed wound consideration starting now and into the foreseeable future and has demonstrated gainful for an assortment of wounds. Hydro conductive dressings are another class that is rising with concentrates in progress. Different modalities, for example, hyperbaric oxygen, development factors, biologic dressings, skin substitutes, and regenerative materials have likewise demonstrated effective in propelling the wound-healing procedure through an assortment of components. The eventual fate of wound healing now stays obscure. Barely any high caliber, randomized controlled preliminaries assessing wound dressings exist and don't obviously exhibit predominance of numerous materials or classifications. Relative viability research can be utilized as an instrument to assess topical treatment for wound consideration moving into what's to come. Until further information develop, instruction on the accessible items and legitimate clinical idea must win.

VII. Conclusion

Wounds will effectively secure microscopic organisms, except if steady measures are taken. The bacterial security managed by average retentive cellulose dressings has been demonstrated to be confined, especially within the sight of serous exudate that may jeopardize dressing respectability. Moreover, dressings may shed particles that wait the wound. On the other hand, numerous cutting edge dressings are impenetrable to microscopic organisms, are dispensed with totally, have been found to improve re-epithelialization rates and decrease the event of wound sepsis. As of late, it has been discovered that they could likewise assume a job in forestalling cross-tainting. Expelling run of the mill cellulosic dressings from bacterially colonized wounds frees wound microscopic organisms into the air, and the numbers are moderate to decay. Notwithstanding, utilizing an in vitro wound model, utilization of the hydrocolloid dressing on tentatively colonized wounds brought about altogether less quantities of airborne microbes. Dispersal from wet run of the mill dressings was lower than from dry dressings; in any case, the quantities of microscopic organisms per liter of air following removal of the hydrocolloid dressing were roughly 20% of those watched for cloth. These discoveries have additionally been settled in the facility. To diminish the rate of complexities, damage care when all is said in done, and infection control approaches specifically, requires deliberately restrained cooperation.

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Compliance with the Ethical Issues

- *Ethics approval and consent to participate*

Animal and Human experiment: N/A
Human Data Submission Approval: N/A

- *Consent for publication*

Consent to publish Individual Person's data: N/A

- *Availability of data and materials*

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A Randomized Controlled Trial of *Curcuma Longa* and *Boswellia Serrata* Extract in Osteoarthritis

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Abstract- *Background:* Chronic pain is the major complaint in subjects with osteoarthritis (OA). Non-steroid anti-inflammatory drug (NSAID) is still the drug of choice in Indonesia to treat OA patients. The prolonged consumption of NSAID may lead to many adverse events (AE). Some previous studies showed the extract of *Curcuma longa* and *Boswellia serrata* is a promising potential as therapeutic interventions against OA.

Objective: This study aimed to evaluate the effectiveness and safety of CB extract to relieve symptoms in patients with OA.

Study Design: This was a randomized controlled trial (RCT) in OA patients. The treatment used in this trial were CB extract (350 mg of *Curcuma longa* and 150 mg *Boswellia serrata*) and NSAID (400 mg ibuprofen or 50 mg diclofenac sodium). Subjects were randomized to 3 different groups (Group 1: CB extract and NSAID; group 2: CB extract; group 3: NSAID). Each medication was taken two times per day for four weeks. Paracetamol tablet 500 mg gave to each subject as a rescue medication.

Keywords: *curcuma longa, boswellia serrata, osteoarthritis, WOMAC.*

GJMR-H Classification: *NLMC Code: WE 348*

Strictly as per the compliance and regulations of:

A Randomized Controlled Trial of *Curcuma Longa* and *Boswellia Serrata* Extract in Osteoarthritis

Rizaldy Taslim Pinzon [α], Rosa De Lima Renita Sanyasi [σ], Esdras Ardi Pramudita [ρ] & Septian Dewi Periska [ω]

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Results: There were 105 subjects at the beginning of the study dominated by a female with mean aged 63 years and have osteoarthritis with KL grade II. Seven subjects were lost to follow up, and three subjects excluded from the study due to adverse event. Ninety five subjects (group 1: 36; group 2: 29, group 3: 30) remained for complete analysis. Delta (Δ) WOMAC score defined as the result of subtraction between WOMAC score at a visit I and WOMAC score at visit III. The highest mean of the WOMAC score was in group 1. However, group 1 showed the greatest reduction of WOMAC score after four weeks of treatment (ΔWOMAC = 12.08 ± 18.6). Group 3 has the least WOMAC score reduction (ΔWOMAC = 6.9 ± 16). There was no statistically different ΔWOMAC score between groups (p = 0.367). The highest consumption of rescue medication was in group 3, whereas the least consumption was in group 2. There was no statistical different of rescue medication consumption between groups (p: 0.346). Group 3 was the most frequently group with reported AE, whereas group 2 has the least reported AE. There were no statistically difference from the prevalence of AE between groups at the visit II (p: 0.119) and the visit III (p: 0.767).

Conclusion: CB extract is effective for OA treatment and also has a better safety profile compared to NSAID.

Keywords: curcuma longa, boswellia serrata, osteoarthritis, WOMAC.

I. Introduction

Osteoarthritis (OA) is a chronic inflammatory joint disease and the most common form of arthritis (Loeser et al., 2012; Mobasheri and Mark, 2016). It is one of a common diagnosis in daily clinical practice (Lespasio et al., 2017; Neogi, 2013). It affects not only the knees but also in the hands, feet, and hips (Litwic et al., 2013). The target of OA management is to reduce pain, optimize function, and also modify the process of joint damage (Sofat and Kuttapitiya, 2014). Chronic pain is the most common complaint in subjects with OA (Cedraschi et al., 2013; Lluch et al., 2014). Therefore, patients with OA often depend on analgetic, such as non-steroid anti-inflammatory drug (NSAID). Prolonged consumption of NSAID may lead to many adverse events such as gastrointestinal tract bleeding and cardiovascular problems (Sostres et al., 2013).

Curcumin is the yellow pigment isolated from the rhizomes of *Curcuma longa* (CL). CL is also known as turmeric (Henrotin et al., 2013). Many type of research have been published for CL potency as an anti-inflammatory and analgesic properties (Henrotin et al. 2010). Curcumin has also demonstrated antiapoptotic activity in chondrocytes (Akhtar and Haqqi, 2012). *Boswellia serrata* (BS) is a common ingredient in Ayurvedic medicine. It also has an anti-inflammatory effect and beneficial to treat a chronic inflammatory disease (Siddiqui, 2011).

The OA process is involved in various interleukins and cytokines such as IL-1β and TNFα and proteases degrading enzymes such as MMP-3, MMP-9, and MMP-13 (Akuri et al., 2017). The anti-arthritic potential of curcumin shows its' capability to downregulate the catabolic and degradative effects in cartilage explants, or chondrocytes stimulated with IL-1β, and TNFα and inhibited the production of MMP-3, MMP-9, and MMP-13 (Akhtar and Haqqi, 2012). An oral

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administration of BS extract also resulted in significantly reduced levels of inflammatory mediators (IL-1β, IL-6, TNF-α, IFN-γ, and PGE2) (Umar et al., 2014).

NSAID is still the drug of choice in Indonesia to treat OA patients (Indonesian Rheumatology Association, 2014). Many previous studies showed the extract of CL and BS is a promising potential as therapeutic interventions against OA. The administration of CL extract, BS extract, or its combination is expected to reduce the amount of consumption of NSAID and reduce the adverse events due to the chronic administration of NSAID. The research of the combination of CL extract and BS extract (CB extract) in OA patients in Indonesia is very limited. The main objective of this study was to evaluate the effectiveness of CB extract to relieve symptoms in patients with OA. This study also identify the safety of the administration of CB extract in patients with OA.

II. Materials and Methods

This study was a randomized controlled trial (RCT) held at Bethesda Hospital and Panti Rapih Hospital, Yogyakarta, Indonesia. Subject enrollment at the first visit included male or female patients, age >18 years old, and has knee osteoarthritis with Kellgren-Lawrence grade II or III. Subject with a known hypersensitivity to CB extract, ibuprofen, diclofenac sodium and/or paracetamol, participation in other clinical trial in the last 1 month before this study, pregnant or has a pregnancy program, incompetent to give a consent and answer the questionnaire, or receiving other pain treatment in the last 24 hours before this study excluded in this study. The sample size calculation based on the assumption of a 95% confidence interval and 80% power of the study. The minimum sample requirement was 25 subjects in each group. A total of 100 subjects enrolled for achieving normal distribution. Subjects divided into three groups randomly. The treatment used in this trial were CB extract (350 mg of *Curcuma longa* and 150 mg *Boswellia serrata*) and NSAID (400 mg ibuprofen or 50 mg diclofenac sodium). Group 1 received the CB extract and NSAID, group 2 received CB extract, and group 3 received NSAID. Each medication was taken two times per day for four weeks. Paracetamol tablet 500 mg was given to each subject as a rescue medication. The remaining number of rescue medication at the third visit was calculated at the end of the study. Figure 1 shows the schematic study flowchart. Each subject signed an informed consent form. Subjects followed-up three times with interval of two weeks between each visit.

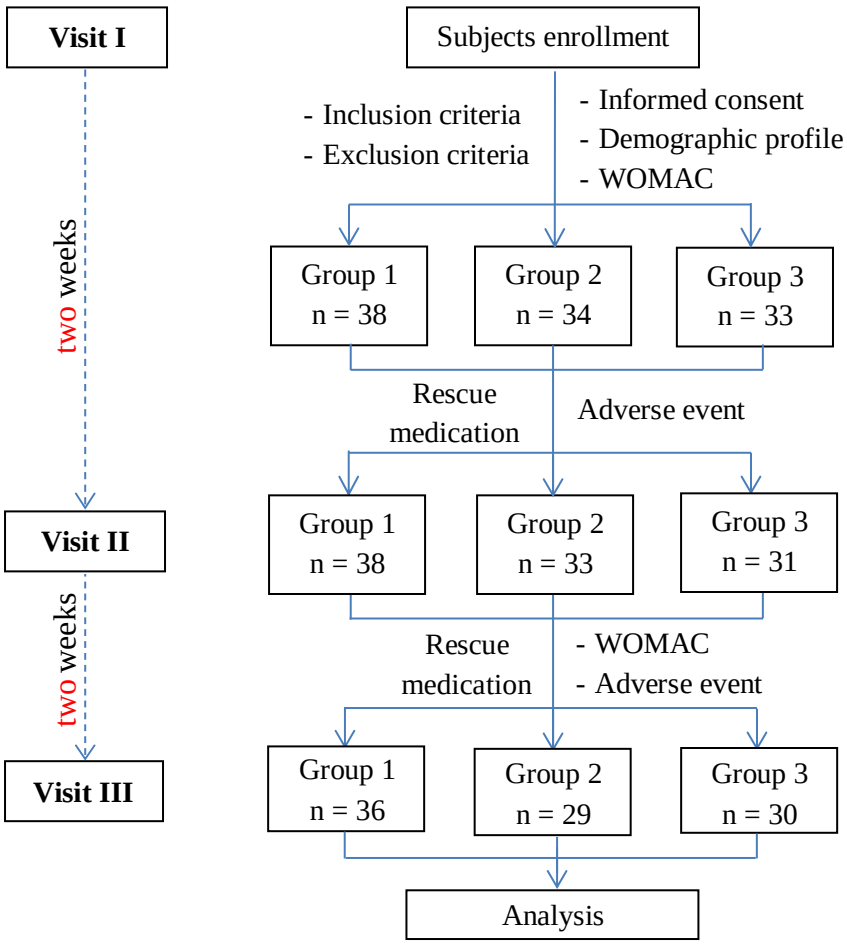

Figure 1: The flowchart of the research

Demographic profile including sex, age, occupation, marital status, education background, comorbidity, and the degree of OA. The degree of knee OA was measured using the Kellgren-Lawrence (KL) grading scale. It determined based on the result of knee X-Ray and interpreted by a radiologist. WOMAC (Western Ontario and McMaster Universities Osteoarthritis Index) commonly used as a standardized questionnaire to evaluate the condition of patients with osteoarthritis. It consists of three categories of questions, five questions for pain, two questions for stiffness, and 17 questions for physical functioning of the joints. Each question is scored on a scale of 0 to 4 (0 = none, 1 = mild, 2 = moderate, 3 = severe, 4 = extreme), thus score range for pain, stiffness, and physical functioning are 0-20, 0-8, and 0-68 respectively. The total score for all questions is 96. The higher score indicates the worse OA symptom. Any adverse event (AE) in this trial would be reported and monitored strictly. The assessment of AE based on the type of AE, the degree of AE, the correlation to the administration of CB extract or NSAID, and the action taken to treat the AE. All data obtained from this study is classified. This study verified by Duta Wacana Christian University School of Medicine Ethical Research Committee, Yogyakarta, Indonesia. The number of ethical clearance is 867/C.16/FK/2018.

The analysis of this study is the intention to treat based. The demographic profile of subjects mentioned in percentage. After the normality test with Kolmogorov-Smirnov test, numeric variables analyzed using a t-test or Wilcoxon signed-rank test. Based on the result of the homogeneity test, ANOVA or Kruskal Wallis test used to identify the mean differences between the three groups. The significant level was set at $p < 0.05$.

III. Results

There were 105 subjects at the beginning of the study dominated by a female (80%) with a mean aged 63 years. About 57.1% of the subjects have osteoarthritis with KL grade II. The detail of subjects' characteristics seen in Table 1. Figure 1 shows the detail of the number of subjects in each group. Seven subjects were lost to follow up and three subjects excluded from the study due to drug's side effect. Ninety-five subjects (36 subjects from group 1, 29 subjects from group 2, 30 subjects from group 3) remained for complete analysis.

Table 1: The subjects' characteristics

Characteristics		n (%)
Age (mean)		63.24 ± 8.77
Gender	Male Female	21 (20%) 84 (80%)
Marital status	Married	78 (74.3%)
	Not married	27 (25.7%)
Occupation	Working Not working	70 (66.7%)
		35 (33.3%)
KL Grade	Grade II Grade III	60 (57.1%)
		45 (42.9%)
Comorbidity	Yes No	79 (75.2%)
		26 (24.8%)

DM: diabetes mellitus, CVD: cardiovascular disease, GIT: gastrointestinal

WOMAC scores tend to be higher of female subjects, single, not working, have a KL grade III, and without any comorbidity. An analysis in these variables proved that age, gender, marital status, occupation, the degree of OA, and the presence of comorbidity were not correlated to the WOMAC score (Table 2).

Table 2: The WOMAC score based on subjects' characteristics

Characteristics		WOMAC Score	p
Age			0.870
Gender	Male Female	32.5 ± 17 37.8 ± 19	0.247
Marital status	Married Not married	36.6 ±19 37.2 ± 19	0.888
Occupation	Working Not working	36.4 ± 20 37.4 ±16	0.793
KL Grade	Grade II Grade III	35.3 ±18 38.7 ±20	0.367
Comorbidity	Yes No	36.58 ± 19 37.2 ± 18	0.880

Table 3 showed the mean of the WOMAC score at visit I and visit III from all subjects, and each group. The highest average of the WOMAC score was in group 1 and the least was in group 2. The reduction of the WOMAC score from visit I to visit III is statistically significant in all groups.

Table 3: The result of WOMAC

Group	WOMAC I (n = 105)			WOMAC III (n = 95)			p
	Min Score	Max Score	Mean Score	Min Score	Max Score	Mean Score	
All subjects	3	73	39.7 ± 19	0	84	27.9 ± 21	<0.001
Group 1	5	73	41.4 ± 19	2	84	30.3 ± 22	<0.001
Group 2	5	73	33.9 ± 17	0	79	26.4 ± 20	<0.001
Group 3	3	69	34.3 ± 20	1	65	26.7 ± 21	0.016

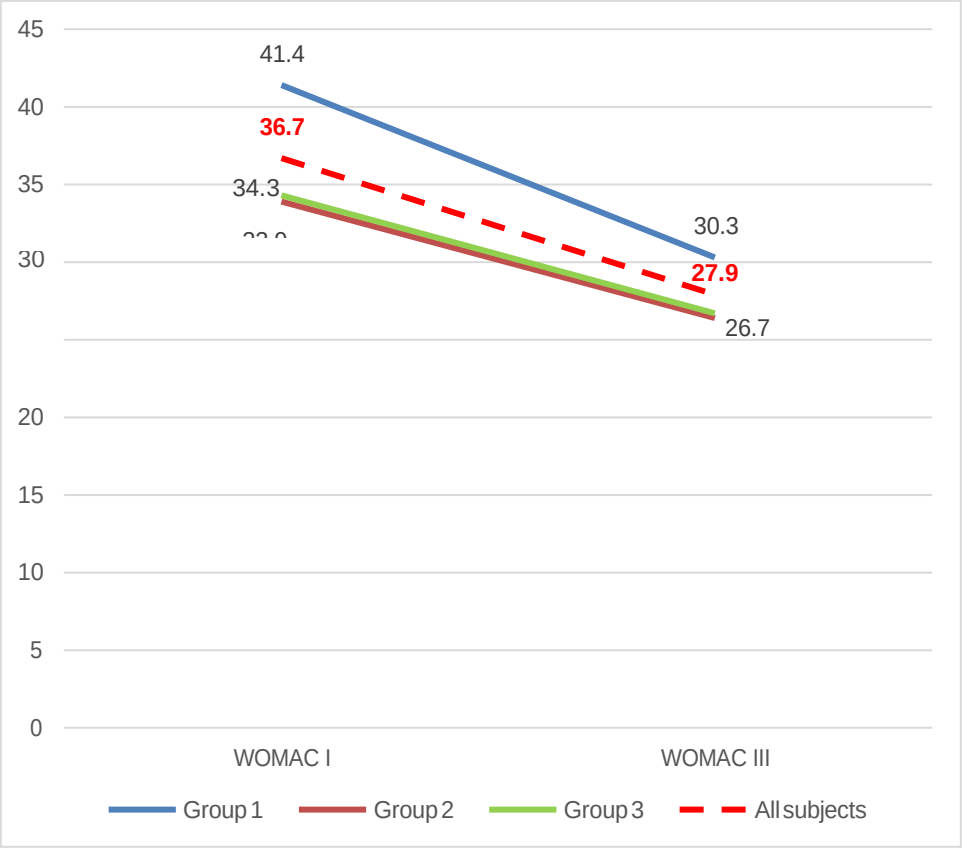

Figure 2: The comparison of WOMAC score mean

Delta (Δ) WOMAC score defined as the result of subtraction between WOMAC score at visit I and WOMAC score at visit III. The highest mean of the WOMAC score was in group 1 (Table 3 and Figure 2). However, group 1 showed the greatest reduction of WOMAC score after four weeks of treatment (ΔWOMAC = 12.08 ± 18.6). Group 3 has the least WOMAC score reduction. There was no statistically different ΔWOMAC score between groups (Table 4).

Each subject was given 20 tablets of 500 mg paracetamol as a rescue medication. At the end of the study, the remaining number of paracetamol calculated. The highest consumption of rescue medication was in group 3 (15 tablets of paracetamol), whereas the least consumption was in group 2 (12 tablets of paracetamol), as seen in Table 5. There was no statistical difference of rescue medication consumption between groups (p: 0.346).

Table 4: The mean of ΔWOMAC score

Medication	Mean ΔWOMAC	p
Group 1 (n: 36)	12.08 ± 19	0.367
Group 2 (n: 29)	7.2 ± 14	
Group 3 (n: 30)	6.9 ± 16	

Table 5: The mean remaining number of paracetamol

Group	The remaining number of rescue medication (mean)	p
Group 1 (n: 36) Group 2 (n: 29) Group 3 (n: 30)	seven tablets eight tablets five tablets	0.346

Group 3 was the most frequent group with reported AE, whereas group 2 has the least reported AE. Abdominal pain was the most common type of AE (n = 7). All of them seen in group 3. The action taken to treat AE based on the symptoms, and the degree of severity. Three subjects need to discontinue the medication due to the AE, two among them were subjects in group 3 and one among them was subject in group 2. No fatal AE reported in all groups and no subject needed an inpatient treatment due to the AE. After a further investigation, only one case (dizziness) of AE that related to the administration of CB extract and 5 cases (abdominal pain) related to the administration of NSAID. There were no statistically different from the prevalence of AE between groups at the visit II (p: 0.119) and the visit III (p: 0.767). Table 5 shows the detail of the AE in each group.

Table 6: Number and type of adverse events

Groups	Visit II	p	Visit III	p
Group 1 (n: 5)	1 (mild lip swelling)	0.119	4 (flank pain, constipation, nausea and loss of appetite, malaise, and dizziness)	0.767
Group 2 (n: 4)	2 (dizziness and urticaria)		2 (nausea and loss of appetite, dizziness)	
Group 3 (n: 7)	5 (abdominal pain)		2 (abdominal pain and muscle pain/spasm)	

IV. Discussion

The present study aimed to identify the effectiveness of CB extract compared to the combination of CB extract and NSAID with NSAID alone. Each medication was taken two times per day for four weeks. The measurement was using WOMAC. The WOMAC was the most commonly used in OA patients. It used to measure the severity and frequency of symptoms. The higher scores indicate a higher severity (Grover and Samson, 2016).

The result of this study was indicated the administration of both CB extract and NSAID or its combination improve the symptom of OA (Table 3). Group 1 had the greater reduction of WOMAC score after four weeks of treatment, followed by group 2 and group 3 (Table 4). The administration of CB extract alone has a greater reduction in the severity and frequency of OA symptoms than the administration of NSAID alone. This study was similar to many previous studies. An administration of CL extract, BS extract, or its combination was beneficial in OA patients. About 201 subjects were investigated in a three-arm, parallel-group, randomized, double-blinded, placebo-controlled trial to identify the effects of 333 mg curcuminoids and a combination of 350 mg curcuminoids and 150 mg boswellic acid. The medication was taken orally three times a day for 12 weeks. The administration of a combination of curcumin and boswellic acid had a superior effect size (physical performance tests and the WOMAC joint pain index) than curcuminoid alone (Haroyan et al., 2018).

A study by Bolognesi et al. (2016) administered standard management of OA combined with oral supplementation in 26 subjects compared with a supplementation containing N-acetyl-D- glucosamine, ginger, and BS extract. Significant improvements in the functional outcomes and pain-free walking distance were observed after 1, 3 and 6 months in OA patients supplemented with a combination of N-acetyl-D-glucosamine, ginger, and BS extract (Bolognesi et al., 2016). Treatment with BS extract showed a statistically significant ($p < 0.001$) decrease in WOMAC score after 120 days (Majeed et al., 2018)

In this current study, the CB extract group had the least consumption of rescue medication. Conversely, the NSAID group had the highest consumption of rescue medication (Table 5). A non-randomized, open-labeled, and non-comparative study by Reddy and Faruqui (2016) was using a combination of curcumin 500 mg and piperine 5 mg twice daily for 12 weeks. It showed that the assessment of the WOMAC score at the end of the 12th week showed a statistically significant change from baseline with a reduction in pain, stiffness, and physical function ($p < 0.001$) and showed a trend of decrease in need of rescue medication (Reddy and Faruqui, 2016).

The present study showed that the CB extract group had the least reported AE (Table 6). Nausea and loss of appetite were the most common type of AE in subjects with CB extract medication. No fatal AE was seen in CB extract group. The highest prevalence of AE seen in the NSAID group. NSAID group was also had more excluded subjects due to AE. This result is in concordance with previous studies. The number of AE of abdominal pain/discomfort was significantly higher in the ibuprofen group than that in the *Curcuma domestica* extracts group ($p = 0.046$) (Kuptniratsaikul et al., 2014). A review by Bee and Liew (2010) stated that turmeric and BS are generally well-tolerated. It may cause GIT side effects such as nausea and diarrhea. It was similar to the result of a study by Reddy and Faruqui (2016); three patients reported mild gastrointestinal AE. Supplementation with a combination of N-acetyl-D-glucosamine, ginger, and BS extract are safe, well-tolerated, and also showing the beneficial effect (Bolognesi et al., 2016).

There is still a very limited study which is investigating CB extract in OA patients in Indonesia. The limitation of this study was unblinded assessment of outcomes and a short length of treatment. This research

did not receive any specific grant from funding agencies, in the public, commercial, or not-for-profit sectors.

V. Conclusion

CL extract in combination with BS extract effective for treatment in OA patients. It also has a great safety profile and well-tolerated compared to NSAID.

Conflict of interest

There are no conflicts of interest to disclose.

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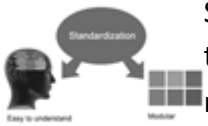

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k) There ought to be references in the conventional format. Global Journals recommends APA format.

Authors should carefully consider the preparation of papers to ensure that they communicate effectively. Papers are much more likely to be accepted if they are carefully designed and laid out, contain few or no errors, are summarizing, and follow instructions. They will also be published with much fewer delays than those that require much technical and editorial correction.

The Editorial Board reserves the right to make literary corrections and suggestions to improve brevity.

Format Structure

It is necessary that authors take care in submitting a manuscript that is written in simple language and adheres to published guidelines.

All manuscripts submitted to Global Journals should include:

Title

The title page must carry an informative title that reflects the content, a running title (less than 45 characters together with spaces), names of the authors and co-authors, and the place(s) where the work was carried out.

Author details

The full postal address of any related author(s) must be specified.

Abstract

The abstract is the foundation of the research paper. It should be clear and concise and must contain the objective of the paper and inferences drawn. It is advised to not include big mathematical equations or complicated jargon.

Many researchers searching for information online will use search engines such as Google, Yahoo or others. By optimizing your paper for search engines, you will amplify the chance of someone finding it. In turn, this will make it more likely to be viewed and cited in further works. Global Journals has compiled these guidelines to facilitate you to maximize the web-friendliness of the most public part of your paper.

Keywords

A major lynchpin of research work for the writing of research papers is the keyword search, which one will employ to find both library and internet resources. Up to eleven keywords or very brief phrases have to be given to help data retrieval, mining, and indexing.

One must be persistent and creative in using keywords. An effective keyword search requires a strategy: planning of a list of possible keywords and phrases to try.

Choice of the main keywords is the first tool of writing a research paper. Research paper writing is an art. Keyword search should be as strategic as possible.

One should start brainstorming lists of potential keywords before even beginning searching. Think about the most important concepts related to research work. Ask, “What words would a source have to include to be truly valuable in a research paper?” Then consider synonyms for the important words.

It may take the discovery of only one important paper to steer in the right keyword direction because, in most databases, the keywords under which a research paper is abstracted are listed with the paper.

Numerical Methods

Numerical methods used should be transparent and, where appropriate, supported by references.

Abbreviations

Authors must list all the abbreviations used in the paper at the end of the paper or in a separate table before using them.

Formulas and equations

Authors are advised to submit any mathematical equation using either MathJax, KaTeX, or LaTeX, or in a very high-quality image.

Tables, Figures, and Figure Legends

Tables: Tables should be cautiously designed, uncrowned, and include only essential data. Each must have an Arabic number, e.g., Table 4, a self-explanatory caption, and be on a separate sheet. Authors must submit tables in an editable format and not as images. References to these tables (if any) must be mentioned accurately.

Figures

Figures are supposed to be submitted as separate files. Always include a citation in the text for each figure using Arabic numbers, e.g., Fig. 4. Artwork must be submitted online in vector electronic form or by emailing it.

Preparation of Eletronic Figures for Publication

Although low-quality images are sufficient for review purposes, print publication requires high-quality images to prevent the final product being blurred or fuzzy. Submit (possibly by e-mail) EPS (line art) or TIFF (halftone/ photographs) files only. MS PowerPoint and Word Graphics are unsuitable for printed pictures. Avoid using pixel-oriented software. Scans (TIFF only) should have a resolution of at least 350 dpi (halftone) or 700 to 1100 dpi (line drawings). Please give the data for figures in black and white or submit a Color Work Agreement form. EPS files must be saved with fonts embedded (and with a TIFF preview, if possible).

For scanned images, the scanning resolution at final image size ought to be as follows to ensure good reproduction: line art: >650 dpi; halftones (including gel photographs): >350 dpi; figures containing both halftone and line images: >650 dpi.

Color charges: Authors are advised to pay the full cost for the reproduction of their color artwork. Hence, please note that if there is color artwork in your manuscript when it is accepted for publication, we would require you to complete and return a Color Work Agreement form before your paper can be published. Also, you can email your editor to remove the color fee after acceptance of the paper.

Tips for writing a good quality Medical Research Paper

1. Choosing the topic: In most cases, the topic is selected by the interests of the author, but it can also be suggested by the guides. You can have several topics, and then judge which you are most comfortable with. This may be done by asking several questions of yourself, like "Will I be able to carry out a search in this area? Will I find all necessary resources to accomplish the search? Will I be able to find all information in this field area?" If the answer to this type of question is "yes," then you ought to choose that topic. In most cases, you may have to conduct surveys and visit several places. Also, you might have to do a lot of work to find all the rises and falls of the various data on that subject. Sometimes, detailed information plays a vital role, instead of short information. Evaluators are human: The first thing to remember is that evaluators are also human beings. They are not only meant for rejecting a paper. They are here to evaluate your paper. So present your best aspect.

2. Think like evaluators: If you are in confusion or getting demotivated because your paper may not be accepted by the evaluators, then think, and try to evaluate your paper like an evaluator. Try to understand what an evaluator wants in your research paper, and you will automatically have your answer. Make blueprints of paper: The outline is the plan or framework that will help you to arrange your thoughts. It will make your paper logical. But remember that all points of your outline must be related to the topic you have chosen.

3. Ask your guides: If you are having any difficulty with your research, then do not hesitate to share your difficulty with your guide (if you have one). They will surely help you out and resolve your doubts. If you can't clarify what exactly you require for your work, then ask your supervisor to help you with an alternative. He or she might also provide you with a list of essential readings.

4. Use of computer is recommended: As you are doing research in the field of medical research then this point is quite obvious. Use right software: Always use good quality software packages. If you are not capable of judging good software, then you can lose the quality of your paper unknowingly. There are various programs available to help you which you can get through the internet.

5. Use the internet for help: An excellent start for your paper is using Google. It is a wondrous search engine, where you can have your doubts resolved. You may also read some answers for the frequent question of how to write your research paper or find a model research paper. You can download books from the internet. If you have all the required books, place importance on reading, selecting, and analyzing the specified information. Then sketch out your research paper. Use big pictures: You may use encyclopedias like Wikipedia to get pictures with the best resolution. At Global Journals, you should strictly follow here.

6. Bookmarks are useful: When you read any book or magazine, you generally use bookmarks, right? It is a good habit which helps to not lose your continuity. You should always use bookmarks while searching on the internet also, which will make your search easier.

7. Revise what you wrote: When you write anything, always read it, summarize it, and then finalize it.

8. Make every effort: Make every effort to mention what you are going to write in your paper. That means always have a good start. Try to mention everything in the introduction—what is the need for a particular research paper. Polish your work with good writing skills and always give an evaluator what he wants. Make backups: When you are going to do any important thing like making a research paper, you should always have backup copies of it either on your computer or on paper. This protects you from losing any portion of your important data.

9. Produce good diagrams of your own: Always try to include good charts or diagrams in your paper to improve quality. Using several unnecessary diagrams will degrade the quality of your paper by creating a hodgepodge. So always try to include diagrams which were made by you to improve the readability of your paper. Use of direct quotes: When you do research relevant to literature, history, or current affairs, then use of quotes becomes essential, but if the study is relevant to science, use of quotes is not preferable.

10. Use proper verb tense: Use proper verb tenses in your paper. Use past tense to present those events that have happened. Use present tense to indicate events that are going on. Use future tense to indicate events that will happen in the future. Use of wrong tenses will confuse the evaluator. Avoid sentences that are incomplete.

11. Pick a good study spot: Always try to pick a spot for your research which is quiet. Not every spot is good for studying.

12. Know what you know: Always try to know what you know by making objectives, otherwise you will be confused and unable to achieve your target.

13. Use good grammar: Always use good grammar and words that will have a positive impact on the evaluator; use of good vocabulary does not mean using tough words which the evaluator has to find in a dictionary. Do not fragment sentences. Eliminate one-word sentences. Do not ever use a big word when a smaller one would suffice.

Verbs have to be in agreement with their subjects. In a research paper, do not start sentences with conjunctions or finish them with prepositions. When writing formally, it is advisable to never split an infinitive because someone will (wrongly) complain. Avoid clichés like a disease. Always shun irritating alliteration. Use language which is simple and straightforward. Put together a neat summary.

14. Arrangement of information: Each section of the main body should start with an opening sentence, and there should be a changeover at the end of the section. Give only valid and powerful arguments for your topic. You may also maintain your arguments with records.

15. Never start at the last minute: Always allow enough time for research work. Leaving everything to the last minute will degrade your paper and spoil your work.

16. Multitasking in research is not good: Doing several things at the same time is a bad habit in the case of research activity. Research is an area where everything has a particular time slot. Divide your research work into parts, and do a particular part in a particular time slot.

17. Never copy others' work: Never copy others' work and give it your name because if the evaluator has seen it anywhere, you will be in trouble. Take proper rest and food: No matter how many hours you spend on your research activity, if you are not taking care of your health, then all your efforts will have been in vain. For quality research, take proper rest and food.

18. Go to seminars: Attend seminars if the topic is relevant to your research area. Utilize all your resources.

19. Refresh your mind after intervals: Try to give your mind a rest by listening to soft music or sleeping in intervals. This will also improve your memory. Acquire colleagues: Always try to acquire colleagues. No matter how sharp you are, if you acquire colleagues, they can give you ideas which will be helpful to your research.

20. Think technically: Always think technically. If anything happens, search for its reasons, benefits, and demerits. Think and then print: When you go to print your paper, check that tables are not split, headings are not detached from their descriptions, and page sequence is maintained.

21. Adding unnecessary information: Do not add unnecessary information like "I have used MS Excel to draw graphs." Irrelevant and inappropriate material is superfluous. Foreign terminology and phrases are not apropos. One should never take a broad view. Analogy is like feathers on a snake. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Never oversimplify: When adding material to your research paper, never go for oversimplification; this will definitely irritate the evaluator. Be specific. Never use rhythmic redundancies. Contractions shouldn't be used in a research paper. Comparisons are as terrible as clichés. Give up ampersands, abbreviations, and so on. Remove commas that are not necessary. Parenthetical words should be between brackets or commas. Understatement is always the best way to put forward earth-shaking thoughts. Give a detailed literary review.

22. Report concluded results: Use concluded results. From raw data, filter the results, and then conclude your studies based on measurements and observations taken. An appropriate number of decimal places should be used. Parenthetical remarks are prohibited here. Proofread carefully at the final stage. At the end, give an outline to your arguments. Spot perspectives of further study of the subject. Justify your conclusion at the bottom sufficiently, which will probably include examples.

23. Upon conclusion: Once you have concluded your research, the next most important step is to present your findings. Presentation is extremely important as it is the definite medium though which your research is going to be in print for the rest of the crowd. Care should be taken to categorize your thoughts well and present them in a logical and neat manner. A good quality research paper format is essential because it serves to highlight your research paper and bring to light all necessary aspects of your research.

Informal Guidelines of Research Paper Writing

Key points to remember:

- Submit all work in its final form.
- Write your paper in the form which is presented in the guidelines using the template.
- Please note the criteria peer reviewers will use for grading the final paper.

Final points:

One purpose of organizing a research paper is to let people interpret your efforts selectively. The journal requires the following sections, submitted in the order listed, with each section starting on a new page:

The introduction: This will be compiled from reference matter and reflect the design processes or outline of basis that directed you to make a study. As you carry out the process of study, the method and process section will be constructed like that. The results segment will show related statistics in nearly sequential order and direct reviewers to similar intellectual paths throughout the data that you gathered to carry out your study.

The discussion section:

This will provide understanding of the data and projections as to the implications of the results. The use of good quality references throughout the paper will give the effort trustworthiness by representing an alertness to prior workings.

Writing a research paper is not an easy job, no matter how trouble-free the actual research or concept. Practice, excellent preparation, and controlled record-keeping are the only means to make straightforward progression.

General style:

Specific editorial column necessities for compliance of a manuscript will always take over from directions in these general guidelines.

To make a paper clear: Adhere to recommended page limits.

Mistakes to avoid:

- Insertion of a title at the foot of a page with subsequent text on the next page.
- Separating a table, chart, or figure—confine each to a single page.
- Submitting a manuscript with pages out of sequence.
- In every section of your document, use standard writing style, including articles ("a" and "the").
- Keep paying attention to the topic of the paper.
- Use paragraphs to split each significant point (excluding the abstract).
- Align the primary line of each section.
- Present your points in sound order.
- Use present tense to report well-accepted matters.
- Use past tense to describe specific results.
- Do not use familiar wording; don't address the reviewer directly. Don't use slang or superlatives.
- Avoid use of extra pictures—include only those figures essential to presenting results.

Title page:

Choose a revealing title. It should be short and include the name(s) and address(es) of all authors. It should not have acronyms or abbreviations or exceed two printed lines.

Abstract: This summary should be two hundred words or less. It should clearly and briefly explain the key findings reported in the manuscript and must have precise statistics. It should not have acronyms or abbreviations. It should be logical in itself. Do not cite references at this point.

An abstract is a brief, distinct paragraph summary of finished work or work in development. In a minute or less, a reviewer can be taught the foundation behind the study, common approaches to the problem, relevant results, and significant conclusions or new questions.

Write your summary when your paper is completed because how can you write the summary of anything which is not yet written? Wealth of terminology is very essential in abstract. Use comprehensive sentences, and do not sacrifice readability for brevity; you can maintain it succinctly by phrasing sentences so that they provide more than a lone rationale. The author can at this moment go straight to shortening the outcome. Sum up the study with the subsequent elements in any summary. Try to limit the initial two items to no more than one line each.

Reason for writing the article—theory, overall issue, purpose.

- Fundamental goal.
- To-the-point depiction of the research.
- Consequences, including definite statistics—if the consequences are quantitative in nature, account for this; results of any numerical analysis should be reported. Significant conclusions or questions that emerge from the research.

Approach:

- Single section and succinct.
- An outline of the job done is always written in past tense.
- Concentrate on shortening results—limit background information to a verdict or two.
- Exact spelling, clarity of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else.

Introduction:

The introduction should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable of comprehending and calculating the purpose of your study without having to refer to other works. The basis for the study should be offered. Give the most important references, but avoid making a comprehensive appraisal of the topic. Describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will give no attention to your results. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here.

The following approach can create a valuable beginning:

- Explain the value (significance) of the study.
- Defend the model—why did you employ this particular system or method? What is its compensation? Remark upon its appropriateness from an abstract point of view as well as pointing out sensible reasons for using it.
- Present a justification. State your particular theory(-ies) or aim(s), and describe the logic that led you to choose them.
- Briefly explain the study's tentative purpose and how it meets the declared objectives.

Approach:

Use past tense except for when referring to recognized facts. After all, the manuscript will be submitted after the entire job is done. Sort out your thoughts; manufacture one key point for every section. If you make the four points listed above, you will need at least four paragraphs. Present surrounding information only when it is necessary to support a situation. The reviewer does not desire to read everything you know about a topic. Shape the theory specifically—do not take a broad view.

As always, give awareness to spelling, simplicity, and correctness of sentences and phrases.

Procedures (methods and materials):

This part is supposed to be the easiest to carve if you have good skills. A soundly written procedures segment allows a capable scientist to replicate your results. Present precise information about your supplies. The suppliers and clarity of reagents can be helpful bits of information. Present methods in sequential order, but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt to give the least amount of information that would permit another capable scientist to replicate your outcome, but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section.

When a technique is used that has been well-described in another section, mention the specific item describing the way, but draw the basic principle while stating the situation. The purpose is to show all particular resources and broad procedures so that another person may use some or all of the methods in one more study or referee the scientific value of your work. It is not to be a step-by-step report of the whole thing you did, nor is a methods section a set of orders.

Materials:

Materials may be reported in part of a section or else they may be recognized along with your measures.

Methods:

- Report the method and not the particulars of each process that engaged the same methodology.
- Describe the method entirely.
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures.
- Simplify—detail how procedures were completed, not how they were performed on a particular day.
- If well-known procedures were used, account for the procedure by name, possibly with a reference, and that's all.

Approach:

It is embarrassing to use vigorous voice when documenting methods without using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result, when writing up the methods, most authors use third person passive voice.

Use standard style in this and every other part of the paper—avoid familiar lists, and use full sentences.

What to keep away from:

- Resources and methods are not a set of information.
- Skip all descriptive information and surroundings—save it for the argument.
- Leave out information that is immaterial to a third party.

Results:

The principle of a results segment is to present and demonstrate your conclusion. Create this part as entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Use statistics and tables, if suitable, to present consequences most efficiently.

You must clearly differentiate material which would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matters should not be submitted at all except if requested by the instructor.

Content:

- Sum up your conclusions in text and demonstrate them, if suitable, with figures and tables.
- In the manuscript, explain each of your consequences, and point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation of an exacting study.
- Explain results of control experiments and give remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or manuscript.

What to stay away from:

- Do not discuss or infer your outcome, report surrounding information, or try to explain anything.
- Do not include raw data or intermediate calculations in a research manuscript.
- Do not present similar data more than once.
- A manuscript should complement any figures or tables, not duplicate information.
- Never confuse figures with tables—there is a difference.

Approach:

As always, use past tense when you submit your results, and put the whole thing in a reasonable order.

Put figures and tables, appropriately numbered, in order at the end of the report.

If you desire, you may place your figures and tables properly within the text of your results section.

Figures and tables:

If you put figures and tables at the end of some details, make certain that they are visibly distinguished from any attached appendix materials, such as raw facts. Whatever the position, each table must be titled, numbered one after the other, and include a heading. All figures and tables must be divided from the text.

Discussion:

The discussion is expected to be the trickiest segment to write. A lot of papers submitted to the journal are discarded based on problems with the discussion. There is no rule for how long an argument should be.

Position your understanding of the outcome visibly to lead the reviewer through your conclusions, and then finish the paper with a summing up of the implications of the study. The purpose here is to offer an understanding of your results and support all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of results should be fully described.

Infer your data in the conversation in suitable depth. This means that when you clarify an observable fact, you must explain mechanisms that may account for the observation. If your results vary from your prospect, make clear why that may have happened. If your results agree, then explain the theory that the proof supported. It is never suitable to just state that the data approved the prospect, and let it drop at that. Make a decision as to whether each premise is supported or discarded or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."

Research papers are not acknowledged if the work is imperfect. Draw what conclusions you can based upon the results that you have, and take care of the study as a finished work.

- You may propose future guidelines, such as how an experiment might be personalized to accomplish a new idea.
- Give details of all of your remarks as much as possible, focusing on mechanisms.
- Make a decision as to whether the tentative design sufficiently addressed the theory and whether or not it was correctly restricted. Try to present substitute explanations if they are sensible alternatives.
- One piece of research will not counter an overall question, so maintain the large picture in mind. Where do you go next? The best studies unlock new avenues of study. What questions remain?
- Recommendations for detailed papers will offer supplementary suggestions.

Approach:

When you refer to information, differentiate data generated by your own studies from other available information. Present work done by specific persons (including you) in past tense.

Describe generally acknowledged facts and main beliefs in present tense.

The Administration Rules

Administration Rules to Be Strictly Followed before Submitting Your Research Paper to Global Journals Inc.

Please read the following rules and regulations carefully before submitting your research paper to Global Journals Inc. to avoid rejection.

Segment draft and final research paper: You have to strictly follow the template of a research paper, failing which your paper may get rejected. You are expected to write each part of the paper wholly on your own. The peer reviewers need to identify your own perspective of the concepts in your own terms. Please do not extract straight from any other source, and do not rephrase someone else's analysis. Do not allow anyone else to proofread your manuscript.

Written material: You may discuss this with your guides and key sources. Do not copy anyone else's paper, even if this is only imitation, otherwise it will be rejected on the grounds of plagiarism, which is illegal. Various methods to avoid plagiarism are strictly applied by us to every paper, and, if found guilty, you may be blacklisted, which could affect your career adversely. To guard yourself and others from possible illegal use, please do not permit anyone to use or even read your paper and file.

Criterion for Grading a Research Paper (Compilation) by Global Journals

Please note that following table is only a Grading of "Paper Compilation" and not on "Performed/Stated Research" whose grading solely depends on Individual Assigned Peer Reviewer and Editorial Board Member. These can be available only on request and after decision of Paper. This report will be the property of Global Journals.

Topics	Grades		
	A-B	**C-D**	**E-F**
Abstract	Clear and concise with appropriate content, Correct format. 200 words or below	Unclear summary and no specific data, Incorrect form Above 200 words	No specific data with ambiguous information Above 250 words
Introduction	Containing all background details with clear goal and appropriate details, flow specification, no grammar and spelling mistake, well organized sentence and paragraph, reference cited	Unclear and confusing data, appropriate format, grammar and spelling errors with unorganized matter	Out of place depth and content, hazy format
Methods and Procedures	Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads	Difficult to comprehend with embarrassed text, too much explanation but completed	Incorrect and unorganized structure with hazy meaning
Result	Well organized, Clear and specific, Correct units with precision, correct data, well structuring of paragraph, no grammar and spelling mistake	Complete and embarrassed text, difficult to comprehend	Irregular format with wrong facts and figures
Discussion	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

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Global Journal of Medical Research

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