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Orthopedic & Musculoskeletal System

Volar Perilunate Dislocation

Translation and Cross-Cultural Adaptation

Highlights

Osteotomy in Thoracolumbar Kyphosis

Pre-injury Activities and Patients Satisfaction

Discovering Thoughts, Inventing Future

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A Prospective Comparison of Vertebral Column Decancellation Versus Pedicle Subtraction Osteotomy in Thoracolumbar Kyphosis

By Yunfei Ouyang, Wang Yan, Zheng Guoquan, Xiao Songhua, Huang Peng & Zhang Xuesong

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Objective: We performed to compare VCD and PSO in correcting kyphosis deformities related to AS.

Keywords: *ankylosing spondylitis; kyphosis; vertebral column decancellation (VCD); Osteotomy; posterior approach.*

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Methods: Seven patients underwent VCD, and nine underwent PSO (4 male, 12 female; mean age 37.9 years; range, 23–65 years). We performed preoperative and postoperative imaging examinations and recorded intraoperative and postoperative general complications. We analyzed radiographic results, complications, and patient satisfaction over a mean follow-up of 3.35 years (range, 9 0.9-3.5.1 years).

Results: The angle correction obtained by a one-segment VCD was significantly, and larger than PSO (40 + 4 vs. 25 + 5 degrees; p<0001). Similarly, the height of the resected vertebral posterior wall after correction by VCD was larger than after PSO (13.3 + 2.6 vs. 7.7 + 2.8 mm; p=0.01). Operative time and blood loss were slightly less after VCD. The global kyphosis correction was not different between the two groups (P=0.9333), nor was the mean Oswestry disability index (ODI) at the final follow-up.

Conclusions: Single-stage, posterior VCD is a proper option to manage severe kyphosis secondary to AS. A single-segment VCD obtains a larger correction than PSO. VCD maintained more of the height of the resected vertebra, which shortened the middle column more than after PSO. A better radiographic correction was noted in the VCD and PSO groups.

Keywords: ankylosing spondylitis; kyphosis; vertebral column decancellation (VCD); Osteotomy; posterior approach.

Key Points

1. The vertebral column decancellation (VCD) and the pedicle subtraction osteotomy (PSO) are two kinds of techniques for correcting the spinal kyphotic deformity.
2. We found VCD has some advantages of decreasing the vertebra column shorten, shortening operation time, lower blood loss, and lower expends. A single-segment VCD obtains a larger correction than PSO.
3. VCD adds one more choice for surgeons correcting severe spinal kyphosis safely.

Mini Abstract- The pedicle subtraction osteotomy (PSO) is commonly used in spinal surgery. We first reported the vertebral column decancellation (VCD) in 2010. There have been no reports comparing VCD and PSO; here we show our experience, the techniques, and outcomes at 3.35 years comparing VCD and PSO, which in correcting kyphosis deformities.

I. Introduction

Ankylosing spondylitis (AS) is an inflammatory disorder that can cause a variety of debilitating orthopedic problems. Among the many musculoskeletal manifestations of AS, spinal deformity is perhaps the most disabling to the patient. If the flexion deformity is excessive, the patient's field of vision is limited to the area near the feet, and walking is extremely difficult. Respiration becomes almost completely diaphragmatic.

Gastrointestinal symptoms resulting from pressure of the costal margin on the contents of the upper abdomen are common.3 In addition to improvement in function, the aesthetic improvement in appearance made by correcting the deformity is important to the patient. If extreme, the deformity should be corrected in two or more stages because of contracture of soft tissues and the danger of injury to the aorta, the inferior vena cava, and the major nerves to the lower extremities.

Pedicle subtraction osteotomy (PSO) as a close wedge osteotomy (CWO) is used most commonly to manipulate deformities related to AS. A single-stage, posterior osteotomy can often provide adequate correction while minimizing the pressure of injury to vascular and retroperitoneal structures positioned anterior to the spine. Traditionally, one can usually achieve 10 degrees of correction with each Smith Petersen osteotomy (SPO), and 30 degrees with a PSO4. Therefore, neither SPO nor PSO in one segment would be expected to achieve adequate correction for patients with severe kyphosis related to AS.

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Polysegmental osteotomies have been suggested for these deformities 5. Vertebral column decancellation (VCD) is a new spinal osteotomy technique for correction of sharp angular spinal deformities first reported in 2011 by our group.2 We have continued to further develop this VCD osteotomy technique in the lumbar spine to manage kyphosis deformities in AS. As a close-opening wedge osteotomy (COWO), theoretically VCD can result in a larger single-stage correction than PSO (Figure 1). Because there have been no reports comparing VCD and PSO, here we report our experience, techniques, and outcomes at 3.6 years comparing VCD and PSO in correcting kyphosis deformities related to AS.

II. Materials and Methods

From January 2009 to December 2013, 16 patients (13 males; 3 females; mean age, 37 years; range,23-51years) with kyphosis secondary to AS underwent operative treatment at ourinstitution. All patients signed the operation informed consent based on the understanding of the operation theoretically. The 16 patients were randomly divided into two groups by a third-party numerical table method without the knowledge of the surgeon or the patient. Seven patients underwent VCD, and nine underwent PSO. The operative technique of VCD includes resection of the posterior elements of 2 adjacent vertebrae, resection of the inferior-posterior aspect of the proximal vertebra, and the superior-posterior aspect of the distal vertebra, Followed by posterior instrumentation/stabilization with pedicle screws and spinal fusion. Preoperative and postoperative osteotomized vertebra height, lumbar lordosis Cobb angle, C7 plumb line, sagittal vertical axis (SVA), and sagittal Cobb angle of the osteotomized segment were documented. The operation time, blood loss, and general complications were documented.

a) Surgical Technique

For the PSO resection, we reported previously a method of transpedicular, bivertebral wedge osteotomy and discectomy to manage the sagittal plane deformity in patients with AS who have chin-brow vertical angles greater than 90°.[6] Fiberoptic intubation preceded the induction of general anesthesia. The patients were placed in the prone position on the operating table, which was flexed in a reverse V shape. Soft protective sponge mats were placed under the chest and abdomen. A midline skin incision was made, and the posterior elements of the lumbar spine were exposed by subperiosteal dissection as far laterally as the transverse processes. Pedicle screws were inserted into several segments above and below the osteotomy level under C-arm fluoroscopic guidance. Laminectomy and facetectomy at the osteotomy site were performed. Then, through the pedicle into the vertebral body and a high-speed drill was used to enlarge the hole. The transverse processes were excised at their bases. With a drill the cancellous bone of the inferior-posterior aspect of the upper vertebra and the superior-posterior aspect of lower vertebra were resected to create a cavity. The posterior and lateral cortex of the body was then resected with angled curettes. The vertebral canal was enlarged by resecting the residual proximal and distal lamina (dome decompression) to avoid compressing the dura while closing the osteotomy. We used to perform two-level PSO procedures for correcting kyphosis beyond 50°, because a one-level PSO can correct only about 30-40° of kyphosis.

(Figure 6) Usually, 1 mm of resected posterior bone will equate to approximately 1° of lordosis once the osteotomy is closed. During the closure of the osteotomy, the pedicle screws that were connected to the temporary short rod were loosened, and compressive forces were applied on the adjacent screws. After the osteotomy site was completely closed, a precontoured rod spanning the entire segments was fixed to the screws and tightened. On the other side, the temporary short rod was removed and replaced with a long permanent rod. Finally, bilateral rods were tightened to the pedicle screws, and the spine was stabilized in the corrected position. This was the standard PSO procedure.

For the VCD procedure, pedicle screws were inserted into 4 or 5 segments similar to the PSO procedure. A larger laminectomy was performed in 2-3 segments to obtain enough correction. Decancellation of the vertebral body was performed with a Y-shaped osteotomy. First, we created a smaller wedge at the significant direction of convex side vertebra using a high-speed drill, with the depth of the wedge being less than one second of the vertebral width. Then, we performed a line-section cut from the vertex of the wedge to the concave side. The approach for creating the small wedge can be transpedical or transvertebral (Figure 2). For the case in Figure 4, we used a transvertebral approach. The cortex of the concave side was weakened rather than resected, which conveniently prevented translation of the osteotomy section. The smaller wedge and the line-section compose the Y-shaped osteotomy, which is a 360°, circumferential decancellation. The two surfaces of the wedge are closed and osteoclasis of the concave cortex occurred during correction of the kyphosis (Figure 2). The VCD is an incomplete resection of vertebral decancellation; a part of cancellous bone and the posterior vertebral posterior that were preserved serve the role of “Bony cage”, which prevents excessive shortening of the spinal cord during the correction of the kyphosis. We consciously extend the distance between the upper, and lower pedicle screws of the osteotomized vertebra in case this “Bony cage” collapses during correction of the kyphosis.

b) Radio Radiographic assessment

Full-length anteroposterior and lateral radiographs in the standing position obtained preoperatively and postoperatively, were used to make radiographic comparisons. In the sagittal plane, we measured the distance between the C7 plumb line and the posterior superior corner of S1, lumbar lordosis from L1 to S1, and global kyphosis. The height variation of the middle column was regarded as the height variation of the posterior wall of the resected vertebral body. We assessed the degree of middle column shortening by comparing the height of the posterior wall of the resected vertebra before and after surgery.

c) Statistical analysis

The SPSS software 18.0 was used for statistical analysis. Comparison between VCD and PSO was made using students t-test. The differences were regarded as significant when $P<0.05$. Continuous data are expressed as mean + standard deviation.

III. Results

a) Surgical results

One-level osteotomy was performed in all VCD cases (n=7). For the PSO cases, the most frequent level of osteotomy was L3 followed by L1, and 5 cases underwent two-level osteotomies (n=9). In the VCD group, the mean operation time was 297 min (range, 180– 540 min), while for the PSO group, the mean operating room time was 325 min (range, 241-610 min). The average estimated blood loss was 2,400 ml (range, 1,200–5,000 ml) in VCD group and 2,800 ml (range, 1,860-6,000 ml) in PSO group. Compared with PSO, VCD resulted in a shorter operative time and less bleeding ($P<0.05$ each).

b) Radiographic results

The basic demographic and radiographic data are list in Table 1. Significant differences were observed between the 2 groups in terms of the corrective contribution and the postoperative height of the posterior wall of the resected vertebra (Table 2). In the VCD group, the one level osteotomized mean angle was 40 + 4 degrees while for the PSO group it was 25 + 5. The corrective contribution of 1 VCD is nearly equal to 1.5 PSO in correction of the kyphotic angle at the osteotomy site ($P<0.05$). The height of the posterior wall of the resected vertebra after correction in the VCD group was greater than in the PSO group (13.3 + 2.6 vs 7.7 + 2.8 mm; $P=0.0010$). The postoperative height of VCD was ≥1/2 the preoperative height itself compared to ≤1/3 in the PSO group (Figure 3). The preoperative and postoperative global kyphosis, the SVA and lumbar lordosis did not show significant differences between the 2 groups ($P>0.05$). Bony healing area was observed by one year follow up radiographs and CTs in patient underwent VCD osteotomy (Figure 7).

c) Complications

Two patients in the VCD group and 3 patients in the PSO group experienced perioperative complications. In the VCD group, sagittal subluxation of the segments caudal to the osteotomy site was observed in 1 patient during the closure of the L2 osteotomy. Dural tear secondary to adhesions with the ossified ligamentum flavum occurred in 1 patient in PSO. One patient in the VCD group developed a paralytic ileus and one in the PSO group developed a transient neurologic deficit. No vascular complications were observed in either group.

d) Outcome analysis

At the final follow-up, the mean Oswestry disability index (ODI) was 30 (range 5-51) in the VCD group and 28 (range, 8-37) in the PSO group and was not significantly different between the two groups.

IV. Discussion

The first SPO was described in 1945 by Smith-Petersen as a one or two-level osteotomy for deformities of AS.8 A PSO is performed by removing the posterior elements and pedicles and decancellating the vertebral body, which then hinges on the anterior cortex.

For patients with severe, rigid, thoracolumbar kyphosis, a single PSO will accomplish approximately 30° to 40° correction, but still leaving a residual kyphosis of large magnitude postoperatively. [7, 10] Therefore, it is often necessary to perform a PSO at 2 or 3 segments if the required correction exceeds 40°; Figure 6 shows a 23-year-old male with AS in whom we performed a two-level (L1/L3) PSO. However, two PSOs result in substantial blood loss, extra surgical trauma, and the potential for more neurologic complications. 10 If the kyphosis is corrected by more than 40° in these closing wedge osteotomy procedures, the spinal cord may become too long for the shortened vertebral column and may be curved, kinked, and potentially damaged because the hinge of the correction is positioned at the anterior longitudinal ligament at the apex of the deformity.

Moreover, a PSO is not universally successful in achieving the best sagittal correction. In contrast, COWO may be considered in patients with severe thoracolumbar kyphosis secondary to AS who require a large magnitude of correction with the anticipated correction being much more than 35° after a 1-level osteotomy.[11] VCD is one type of COWO, which is an incomplete resection of vertebral decancellation, and a part of the bone is preserved to serve as a “Bony cage” to prevent excessive spinal cord bucking during correction. The position of the bony cage is due to the 3-dimensional status of the deformities; therefore, VCD can be considered as a flexible osteotomy for multiplanar deformities both with coronal and sagittal imbalance, especially for rigid spinal deformities.

Current techniques of vertebral column resection (VCR) may result in greater correction. During the close-opening procedure, the anterior column is opened and lengthened; simultaneously, the center of correction is moved posterior to achieve the greater sagittal correction, and the posterior and middle columns are shortened. If necessary, a strut autograft or a rectangular mesh packed with bone graft can be inserted through the posterior approach into the intervertebral gap to provide interbody support [12, 13, 17, 20] Kawahara and colleagues concluded that a bone correction exceeding 40° or 50° can be achieved by COWO without compromising the integrity of the spinal cord.[12] Lenke et al reported 147 consecutive pediatric VCRs performed by 7 surgeons and demonstrated excellent radiographic correction. The posterior VCR was shown to be safe and effective in this large series of patients. These complex reconstructions, however, were associated with a 59% complication rate, thus emphasizing the challenging nature of these patients and procedures.[14]

In the elderly patient, PSO and VCR can restore sagittal and coronal balance and substantial improvement in quality of life, but both techniques can lead to serious complications and should be used selectively.[15] Complete and circumferential resection of one vertebra at a single level allows for tremendous correction quality in both the sagittal and coronal planes in a controlled fashion without the need for more than one more segment to be osteotomized. In AS, correction of sagittal plane deformities can be achieved by lengthening the anterior elements, shortening the posterior elements, or a combination of the two. Usually, coronal imbalance is accompanied by sagittal imbalance.

A failed operation for deformity or a congenital disorder can result in a rigid coronal imbalance.9 In the VCD procedure, however, the hinge shifts to the posterior aspect of the spinal cord in contrast to the PSO correction which is achieved by passive extension of the lumbar spine to close the posterior osteotomy and with an anterior hinge. Internal transpedicular fixation has been used to ensure immediate stability and rapid consolidation. [16, 17] VCD correction is achieved with a more posterior hinge. A single level VCD for thoracolumbar kyphosis can result in up to 40°-70° of correction; the Y-shaped osteotomy of the VCD is one type of COWO that effectively decreases the shortening of the middle vertebra column. The position of the bony cage is due to the 3-dimensional status of the deformity; therefore, VCD is a flexible osteotomy for multiplanar deformities with both coronal and sagittal imbalance, and especially so for rigid spinal deformities (Figure 8 4). This advantage of a VCD allows a greater degree of correction than PSO. Although a VCR is regarded as allowing the greatest correction,[18] VCR needs interbody implants to maintain the height of middle column[13]. VCD adds one more choice for surgeons correcting severe spinal kyphosis safely.

Abbreviations

AS - Ankylosing Spondylitis
COWO - Close-opening Wedge Osteotomy
CWO - Close Wedge Osteotomy
ODI - Oswestry Disability Index
PSO - Pedicle Subtraction Osteotomy
SPO - Smith-Petersen Osteotomy
VCD - Vertebral Column Decancellation
SVA - Sagittal Vertical Axis
SPSS - Statistical Product and Service Solutions
VCR - Vertebral Column Resection

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Table 1: Patient demographics. * indicates that the patient underwent total hip replacement (THR)

Group	Cases	Sex	age	Site of Osteotomy	Osteotomy angle (º)	SVA (cm)		Lumbar lordosis (º)		Vertebra Height (mm)	
						Pre	Post	Pre	Post	Pre	Post
VCD	1	F	49	L1	42	15	0	39	-66	17	14
	2	M	43	L3	32	19	5	36	-50	21	12
	3	M	48	L3	38	28	9	36	-53	22	11
	4*	M	51	L2	42	20	5	33	-76	25	18
	5	M	36	L2	42	11	1	3	-51	22	12
	6	M	35	L2	45	90	35	3	-47	30	15
	7	M	24	L2	38	72	20	2	-36	20	11
PSO	8	M	41	L2	40	21	0	12	-56	26	6
	9*	M	35	L1/3	16/30	28	8	30	-33	22/22	18/8
	10	F	42	L1/3	28/21	30	5	42	-60	20/22	8/8
	11	M	34	L2	24	80	50	0	-42	22	8
	12	M	24	L3	32	100	80	-2	-48	23	10
	13	M	25	L1/3	21/37	25	3	28	-30	22/22	6/3
	14	M	41	L1	30	15	4	5	-45	23	7
	15	M	23	T12/L2	20/22	150	60	3	-27	23/25	6/13
	16	F	34	L2	21	100	60	15	-58	20	8

Table 2: Radiographic data comparing PSO and VCD

Group	Pre/Post operation	Osteotmized vertebral angle (degrees)	Height of vertebral posterior wall	Lumbar lordosis (degrees)	Global kyphosis (need	SVA (cm)	GK mean correction (%)	Mean correction for every vertebra	Mean umber of resected vertebra
PSO	Pre op	0	22 ± 4	13(±16.)	88(±17)	17.7(±8.8)	54%	32 vertebra	32/21(1.524)
(n=21)	Post op	25(±5)	7.7(±3)	-42(±12)	41(±10)	5.3(±1.6			
VCD	Pre op	0	22(±1)	22(±18)	84(±13.1)	16.3(±7.1)	49%	39/vertebra	21/20(1.050)
(n=20)	Post op	40(±4)	13(±3)	-54(±13)	43(±12)	3.2(±3.1)			
P		p<0.01	0.01	0.11	0.93	0.37			

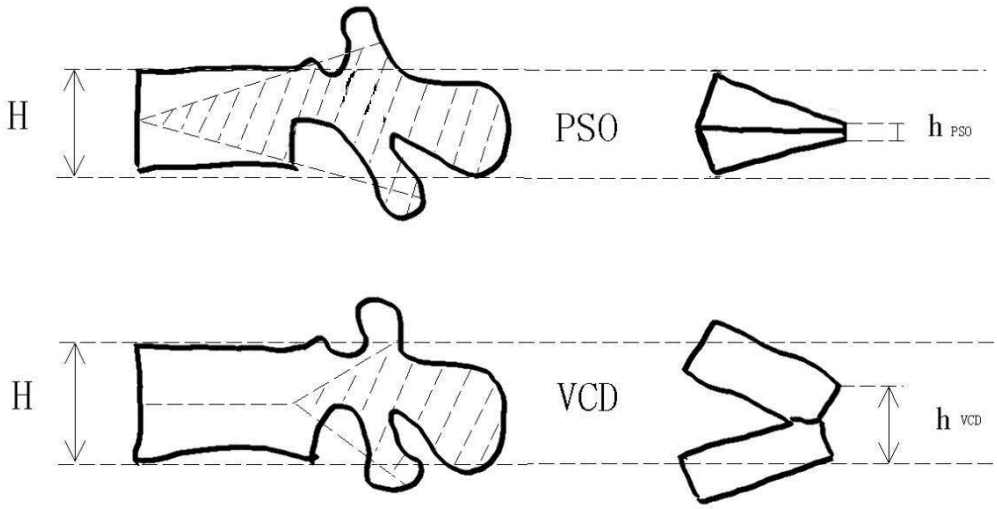

Figure 1: Comprative illustration of PSO and VCD procedures. The osteotomized angle of PSO is less than that of VCD. The middle column after VCD procedure is much greater than after PSO

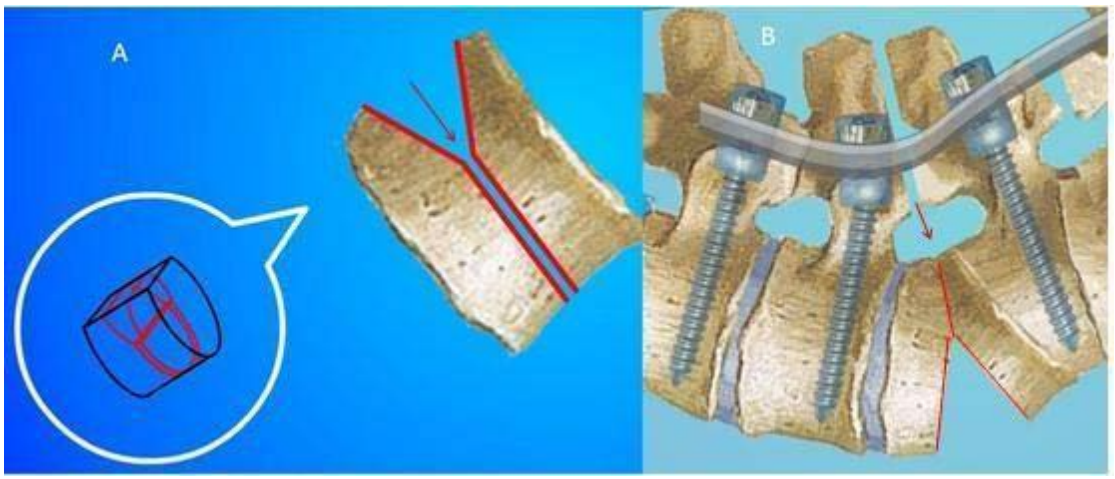

Figure 2: VCD Y-shaped osteotomy procedure A: The smaller wedge and the line-section compose Y-shaped osteotomy; it is a 360° circumferential decancellation. B: The two surfaces of the wedge are closed and osteoclasis of the concave cortex occurred during correction

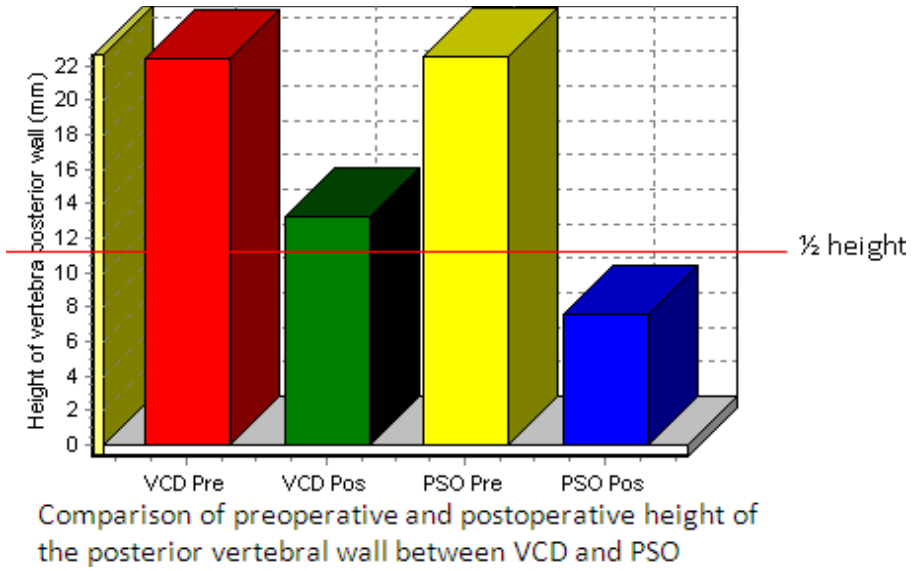

Figure 3: The postoperative height of VCD ≥1/2 the preoperative height, the height of PSO i s ≤1/3 of the preoperative height. Height of the posterior wall of the resected vertebra after correction in VCD was greater than after PSO (P=0.0010)

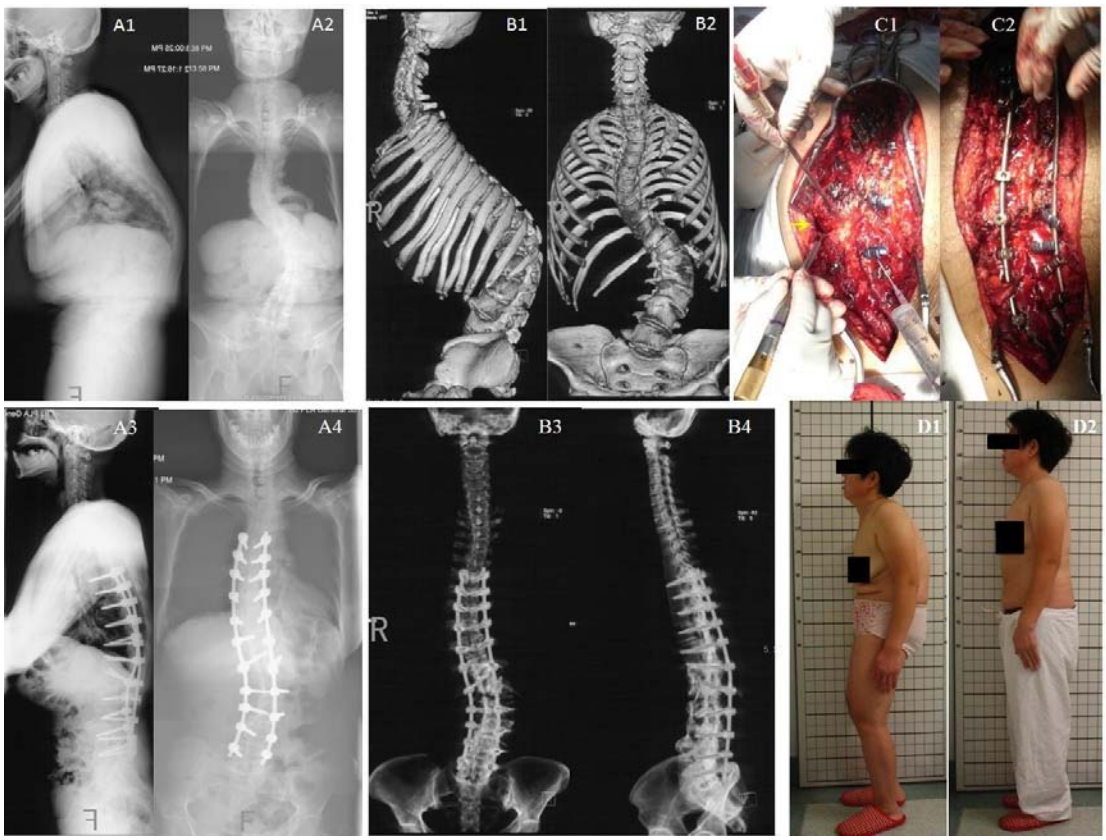

Figure 4: (A1-2) Standing lateral and anteroposterior radiographs of a 49-year-old female with a deformity of AS. (A3-4) The patient underwent L1 VCD osteotomy. (B1-2) anteroposterior and lateral CT s show the thoracolumbar deformities both in the sagittal and coronal planes. (B3-4) Sagittal and coronal balances were both restored. (C1-2) The approach of this VCD osteotomy was not a transpedicular resection but a transvertebral procedure, which has the advantage of obtaining a multidimensional correction (yellow arrow indicates the transvertebral site). (D1) Preoperative lateral view. (D2) Postoperative lateral view shows the correction of the deformity with VCD osteotomy at L1

Figure 5: These two patients underwent VCD and PSO. The preoperative and postoperative heights of the posterior wall of the resected vertebras were measured (pre/postoperatively: VCD 17/14 mm, PSO 20/6 mm)

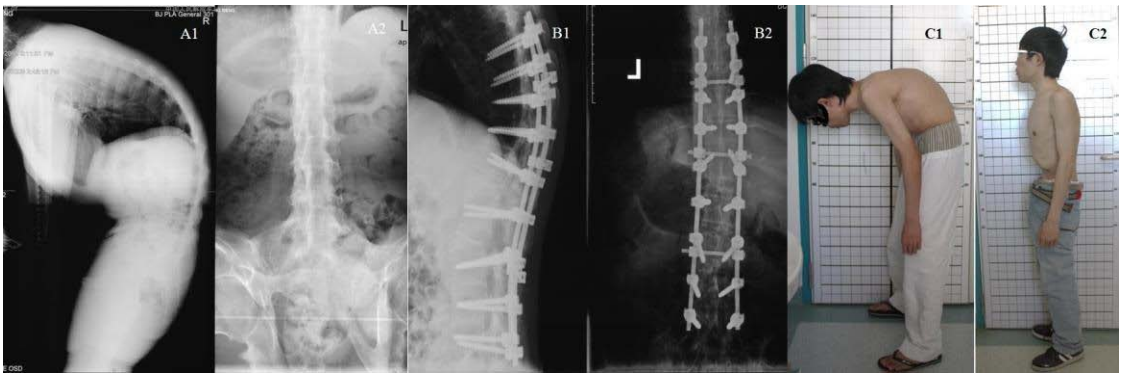

Figure 6: A 23-year-old male with AS kyphosis deformity secondary to AS underwent a 2-level PSO correction. (A1-2) Preoperative standing lateral and anteroposterior radiographs, the patient then underwent L1 and L3 PSO. (B1-2) Postoperative lateral and anteroposterior radiograph

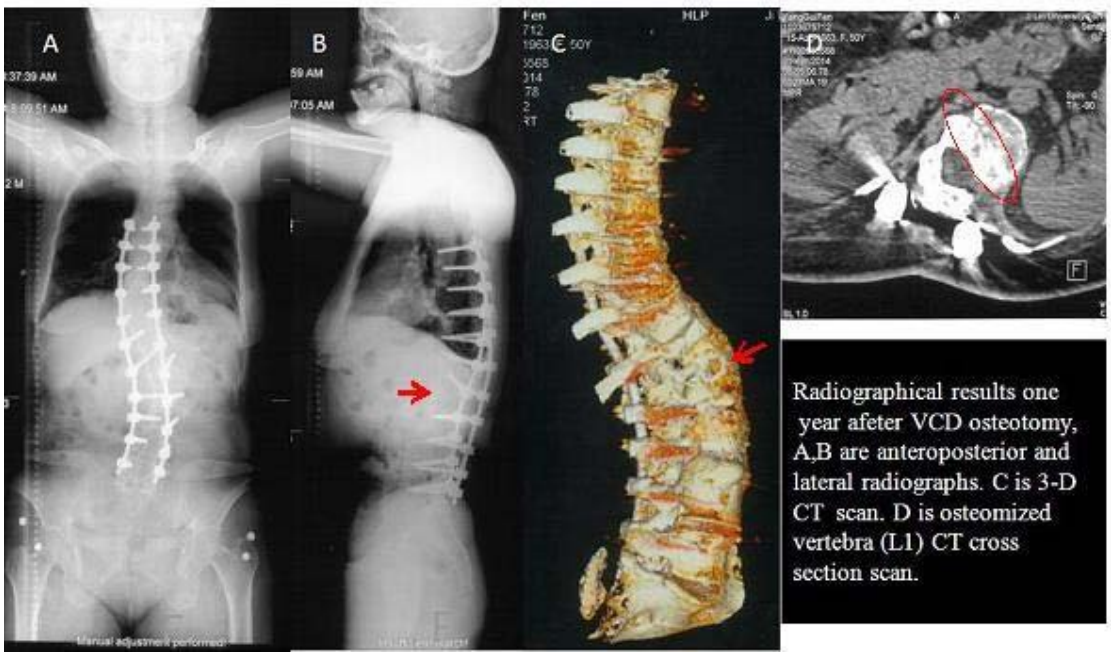

Figure 7: One year follow up radiographs and CTs of the 49 female patient underwent VCD osteotomy in Figure 4. Osteotomised segment was marked by red arrow in B and C, and bony healing area was observed in C which marked by red ring

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Neglected Trans-Scaphoid Volar Perilunate Dislocation with Post-Operative Complex Regional Pain Syndrome: A Case Report

By Apoorv Sehgal, Pratyush Shahi, Aarushi Sudan, Sushil Kamal, Umesh Meena & Debasish Meher

Abstract- We present the case report of a 30-year-old male who fell from a height of 15 feet on his palmar-flexed right wrist and came to us 1 month after the injury. He had a swollen, stiff wrist with painful movements and no neurovascular deficit. X-rays showed a trans-scaphoid volar perilunate dislocation. We used the volar approach for open reduction and internal fixation with a headless screw for scaphoid fracture and scapho-lunate and capito-lunate K-wires for intercarpal instability. The wrist was immobilised in a below-elbow POP slab for 6 weeks after which the K-wires were removed. The patient unfortunately developed complex regional pain syndrome (CRPS), which can be attributed to his late presentation after the injury. Active and passive range of motion exercises and contrast bath were initiated and he was kept on low dose amitriptyline. Gradually CRPS resolved and at 6-month follow-up, the patient had a wrist dorsiflexion of 30° and palmar-flexion of 45°.

GJMR-H Classification: *NLMC Code: WE 175*

Strictly as per the compliance and regulations of:

Neglected Trans-Scaphoid Volar Perilunate Dislocation with Post-Operative Complex Regional Pain Syndrome: A Case Report

Apoorv Sehgal [α], Pratyush Shahi [σ], Aarushi Sudan [ρ], Sushil Kamal [ω], Umesh Meena [¥] & Debasish Meher [§]

Abstract- We present the case report of a 30-year-old male who fell from a height of 15 feet on his palmar-flexed right wrist and came to us 1 month after the injury. He had a swollen, stiff wrist with painful movements and no neurovascular deficit. X-rays showed a trans-scaphoid volar perilunate dislocation. We used the volar approach for open reduction and internal fixation with a headless screw for scaphoid fracture and scapho-lunate and capito-lunate K-wires for intercarpal instability. The wrist was immobilised in a below-elbow POP slab for 6 weeks after which the K-wires were removed. The patient unfortunately developed complex regional pain syndrome (CRPS), which can be attributed to his late presentation after the injury. Active and passive range of motion exercises and contrast bath were initiated and he was kept on low dose amitriptyline. Gradually CRPS resolved and at 6-month follow-up, the patient had a wrist dorsiflexion of 30° and palmar-flexion of 45°.

I. Introduction

Volar perilunate dislocation (VPLD) is a rare injury accounting for about 3% of perilunate dislocations which comprise of less than 10% of all wrist injuries.[1] It generally occurs due to high-energy trauma and is frequently missed. Open reduction and internal fixation is the ideal treatment due to variable results with closed reduction.[2] Patients presenting late are particularly difficult to manage due to soft tissue contractures and increased chances of 1) avascular necrosis of scaphoid and lunate, 2) tractional injury to neurovascular structures, 3) wrist stiffness, and 4) complex regional pain syndrome (CRPS).[3]

We, through this case report, aim to highlight the problems faced in managing neglected VPLDs and importance of prompt restoration of intercarpal alignment in such injuries to prevent complications. We also state that early recognition and treatment improves patient outcomes in CRPS.

II. Case Presentation

A 30-year-old man presented to us with pain in the right wrist and restricted movements. He had fell down from a height of around 15 feet on his palmar-flexed wrist a month back. He took the primary treatment from an osteopath where some kind of bandaging was done. He came to us when his symptoms hadn't subsided one month after the injury. On examination, there was diffuse tenderness and swelling over the right wrist with restriction of movements. The overlying skin was normal. There was no weakness or paresthesia in the right hand. X-rays suggested a trans-scaphoid volar perilunate dislocation. *(Figure 1)*

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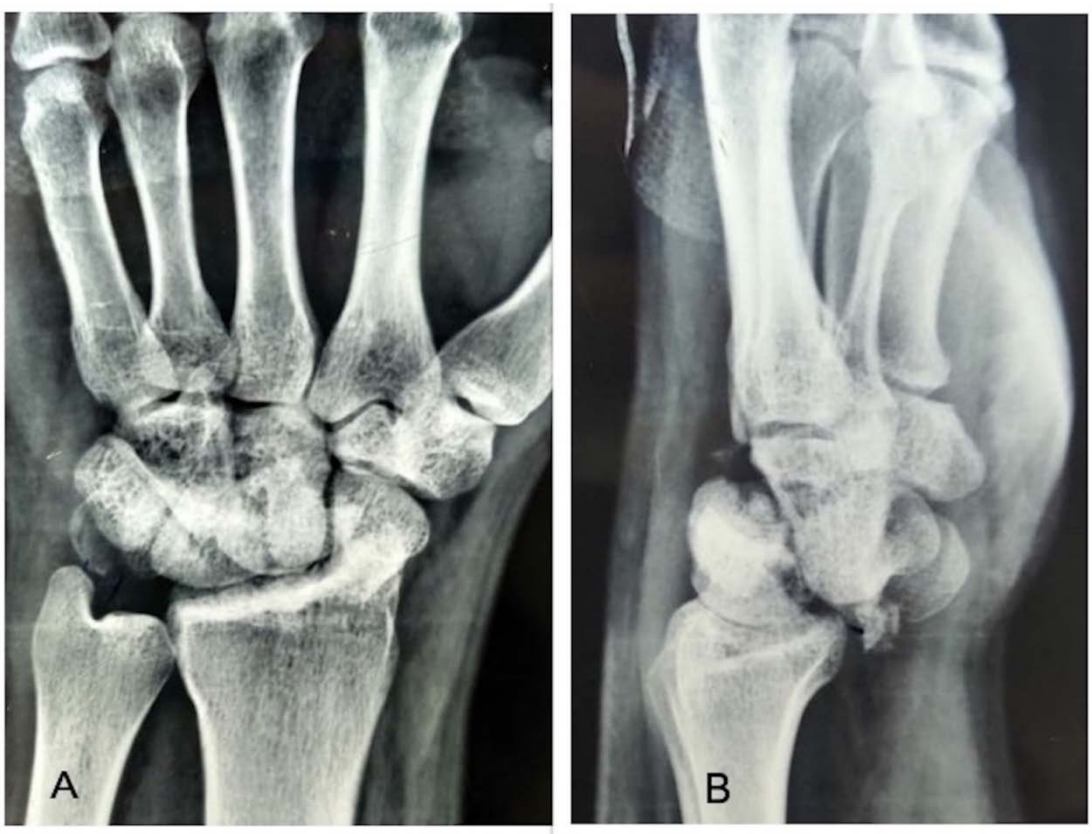

Figure 1: Shows (A) disruption of Gilula's lines, crowding of carpals and fracture of the waist of scaphoid on the anteroposterior view, and (B) trans-scaphoid volar perilunate dislocation on the lateral view

After taking an informed consent, we took the patient to the operating table. We used the volar approach to the scaphoid. Intra-operatively, we found a comminuted fracture of the scaphoid and gross intercarpal instability. We did open reduction and internal fixation with a headless screw for scaphoid fracture and scapho-lunate and capito-lunate K-wires for intercarpal instability.

The patient was kept on a below-elbow plaster slab for 6 weeks, after which it was removed along with the K-wires and range of motion exercises were started. Unfortunately, the patient developed complex regional pain syndrome (CRPS) at this point, which was suggested by his complaints of severe burning pain and abnormally increased sweating in the affected area. X-rays showed severe patchy osteopenia around the wrist. Active and passive range of motion exercises and contrast bath were initiated and he was kept on low dose amitriptyline. Gradually CRPS resolved and at 6-month follow-up, the patient had a wrist dorsiflexion of 30° and palmar-flexion of 45°. *(Figure 2)*

Figure 2: Shows X-rays (A) at 6 weeks and (B) upon K-wire removal depicting severe patchy osteopenia suggestive of complex regional pain syndrome (CRPS); (C) at 4 months with partial resolution of CRPS

III. Discussion

Perilunate dislocation comprises volar or dorsal transalation of the carpus secondary to ligamentous or bony disruption around the lunate. This was explained by Johnson as greater arc (associated with a fracture around lunate) and lesser arc (pure ligamentous disruption around lunate) injuries.[4]

Trans-scaphoid volar perilunate dislocation (VPLD) is an extremely rare injury, generally caused by a fall on palmar-flexed and ulnar-deviated wrist.[5] It is frequently missed and hence, can be neglected. Patients can present with persistent pain and stiffness of the wrist joint with signs of median nerve compression.

Prompt restoration of intercarpal alignment is necessary to prevent complications like median nerve injury, carpal instability, complex regional pain syndrome, avascular necrosis of lunate and scaphoid, and secondary osteoarthritis.[6] The literature suggests that an open reduction is necessary and can be done till 2 months after the injury.[7] In patients where open reduction is not successful or those presenting after 2 months, a reconstructive or salvage procedure is generally required.[3]

Patients presenting late with VPLDs have more chances of developing complex regional pain syndrome (CRPS) in the post-operative period. CRPS occurs due to central and peripheral nociceptive sensitisation, altered sympathetic function, inflammatory and immune related factors, brain changes, and psychological factors.[8] It is characterised by excessive burning pain, swelling, altered sweating pattern and warm or cold skin. Diagnosis is solely clinical. Early recognition and treatment is necessary. Various treatment modalities like drugs (corticosteroids, anti-convulsants, analgesic anti-depressants), ganglion blocks, spinal cord stimulation and physical therapy have been documented.[9]

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Clinical Outcome, Return to Pre-Injury Activities and Patients Satisfaction after Open ACL Reconstruction and Arthroscopic Reconstruction; An Experience from a Developing Country

By Prof. Shehzad Javed, DR. Muhammad Farrukh Bashir, Dr. Zubair Khalid, Dr. Umair Ahmed & Prof Amer Aziz

Abstract- Introduction: There are two techniques for reconstruction of anterior cruciate ligament (ACL), open technique and arthroscopic assisted technique. Arthroscopic assisted technique has many advantages over open procedure but it needs more expertise and cost comparatively. The objective of this study is to identify the clinical outcomes on basis of lyshlomknee score (LKS) system and find out patients satisfaction after performing both procedures in two groups separately.

Material and Methods: Retrospective analysis of 600 patients undergoing open ACL reconstruction and arthroscopic reconstruction from 2005 to 2018 was done, at the Department of Orthopaedics, Ghurki Hospital, Lahore. We included all those patients who were 18 to 45 years of age and had at least 1 year follow up.

Keywords: anterior cruciate ligament (ACL), open technique, arthroscopic assisted technique, lyshlomknee score (lks), satisfaction.

GJMR-H Classification: NLMC Code: WE 168

Strictly as per the compliance and regulations of:

Clinical Outcome, Return to Pre-Injury Activities and Patients Satisfaction after Open ACL Reconstruction and Arthroscopic Reconstruction; An Experience from a Developing Country

Prof. Shehzad Javed [α], DR. Muhammad Farrukh Bashir [σ], Dr. Zubair Khalid [ρ], Dr. Umair Ahmed [ω] & Prof. Amer Aziz[¥]

Abstract- Introduction: There are two techniques for reconstruction of anterior cruciate ligament (ACL), open technique and arthroscopic assisted technique. Arthroscopic assisted technique has many advantages over open procedure but it needs more expertise and cost comparatively. The objective of this study is to identify the clinical outcomes on basis of lyshlomknee score (LKS) system and find out patients satisfaction after performing both procedures in two groups separately.

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Results: Out of 600 patients, there were 554 (92.3%) male and 46 (7.7%) female. Mean age of the patients was noted to be 30.2±4.3 years. Overall, mean duration of follow up was noted to be 12 months. Overall, there was no significant difference in between both the groups in terms of gender, age. In open ACL patients, mean LKS was noted to be 82.78 ±14.78 whereas in arthroscopic reconstruction group, mean LKS was noted to be 90.88± 13.22 while the difference between the two groups was statistically significant.

Conclusion: Majority of our patients were male. Although both studied procedures got good overall LKS but patients following arthroscopic reconstruction had significantly better LKS in comparison to open ACL reconstruction.

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Keywords: anterior cruciate ligament (ACL), open technique, arthroscopic assisted technique, lyshlomknee score (lks), satisfaction.

I. Introduction

The Anterior Cruciate Ligament (ACL) has a major role in normal working of knee[1]. Rupture of ACL is one of the most common diagnosis in young patients either due to RTA or sports trauma. Reconstruction of the ACL allows the patient to resume sporting activities and prevents damage in meniscus and articular cartilage in turn reducing chances of arthritis.[2-4] There are two techniques for reconstruction of ACL, open technique and arthroscopic assisted technique. Arthroscopic assisted technique has many advantages over open procedure but it needs more expertise and cost comparatively. Currently, ACL reconstruction is most often performed using an arthroscopic assisted technique.[5]

Literature is deficient of ACL reconstruction data in developing countries. In developing countries like Pakistan, cost is the major issue. Athroscopic assisted ACL reconstruction is more expensive than open procedure. There is no large data available for such population which shows the clinical outcome after open & arthroscopic ACL reconstruction. The objective of this study is to identify the clinical outcomes on basis of lyshlomknee score (LKS) system and find out patients satisfaction after performing both procedures in two groups separately.

II. Material & Methods

Retrospective analysis of 600 patients undergoing open ACL reconstruction and arthroscopic reconstruction from 2005 to 2018 was done at Department of Orthopaedics, Ghurki hospital, Lahore. We included all those patients who were 18 to 45 years of age and had at least 1 year follow up. Amongst these patients, 500atients underwent open ACL reconstruction while 100 had arthroscopic reconstruction.

Lysholm scoring questionnaire as shown in Firgure-1[6,7] was adopted and enquired from all the

patients. Face to face interview was done with all the study participants. If the patient stated that he/she did not understand the question properly, more explanation regarding that particular question was given until the patient understood what he/she was asked. All the study participants were invited to hospital. All those participants who found to be in the clinically stable state, were excluded from this study. All those cases that had any new related injury after ACL reconstruction or arthroscopic reconstruction were also excluded from the study. Patients who had evidence of clinical and radiological degenerative change in the knee were also excluded.A standard script was followed for all the interviews to maintain a level of consistency. All the ethical standards written in "The Declaration of Helsinki 1964"[8] and its later amendments were fully followed in this study.

Means along with standard deviation were calculated for the lysholm scoring between patients undergoing ACL reconstruction or arthroscopic reconstruction. Chi square test was applied to compare the qualitative variables like gender, while remaining quantitative variables like age, duration of follow up and LKS were compared using t-test for any significant difference in between both the groups. P value less than or equal to 0.05 was considered as statistically significant.

SECTION 1 - LIMP
- ☐ I have no limp when I walk. (5)
- ☐ I have a slight or periodical limp when I walk. (3)
- ☐ I have a severe and constant limp when I walk. (0)

SECTION 2 - Using cane or crutches
- ☐ I do not use a cane or crutches. (5)
- ☐ I use a cane or crutches with some weight-bearing. (2)
- ☐ Putting weight on my hurt leg is impossible. (0)

SECTION 3 - Locking sensation in the knee
- ☐ I have no locking and no catching sensation in my knee. (15)
- ☐ I have catching sensation but no locking sensation in my knee. (10)
- ☐ My knee locks occasionally. (6)
- ☐ My knee locks frequently. (2)
- ☐ My knee feels locked at this moment.. (0)

SECTION 4 - Giving way sensation from the knee
- ☐ My knee gives way. (25)
- ☐ My knee rarely gives way, only during athletics or vigorous activity. (20)
- ☐ My knee frequently gives way during athletics or other vigorous activities. In turn I am unable to participate in these activities. (15)
- ☐ My knee frequently gives way during daily activities. (10)
- ☐ My knee often gives way during daily activities. (5)
- ☐ My knee gives way every step I take. (0)

SECTION 5 – PAIN
- ☐ I have no pain in my knee. (25)
- ☐ I have intermittent or slight pain in my knee during vigorous activities. (20)
- ☐ I have marked pain in my knee during vigorous activities. (15)
- ☐ I have marked pain in my knee during or after walking more than 1 mile. (10)
- ☐ I have marked pain in my knee during or after walking less than 1 mile. (5)
- ☐ I have constant pain in my knee. (0)

SECTION 6 – SWELLING
- ☐ I have swelling in my knee. (10)
- ☐ I have swelling in my knee on1y after vigorous activities. (6)
- ☐ I have swelling in my knee after ordinary activities. (2)
- ☐ I have swelling constantly in my knee. (0)

SECTION 7 – CLIMBING STAIRS
- ☐ I have no problems climbing stairs. (l0)
- ☐ I have slight problems climbing stairs. (6)
- ☐ I can climb stairs only one at a time. (2)
- ☐ Climbing stairs is impossible for me. (0)

SECTION 8 – SQUATTING
- ☐ I have no problems squatting. (5)
- ☐ I have slight problems squatting. (4)
- ☐ I cannot squat beyond a 90deg. Bend in my knee. (1)
- ☐ Squatting is impossible because of my knee. (0)

Total: _____/100

Figure 1: Lysholm knee score (LKS)[6,7]

III. Results

In this study, a total of 600 patients were included among these majority 554 (92.3%) were male and 46 (7.7%) were female patients with an average age of 30.2 ±4.3 years. Overall, mean duration of follow up was noted to be 21.4±5.6 months.

Table 1 showed the demographic profile of patients underwent two different surgical procedures, in group 1 500involvedunderwent open ACL among these93% were males and 7% were females with an average age of 30.27+4.2 years and follow up duration of 12 months as compared to group 2 where the patients of arthroscopic reconstruction took part in the study n=100 among these 89% were male participants and 11% were females with an average age of 29.57+4.7years and had the follow up duration of 12 months. The study reveals that there was no significant difference in between both the groups in terms of gender, age but duration of follow up were different in both groups as (p value ≤0.05).

Table 2 demonstrates the functional outcome of patients using Lysholm knee score among two groups of patients. In open ACL patients, majority 55% patients

reported excellent outcome, 30% with good outcome with an average score of 82.78±14.78 whereas in arthroscopic reconstruction group, majority reported excellent functional outcome as 90% reported excellent functional outcome and 2% with poor outcome with an average score of 90.88 ±13.22 and statistically significant difference were obtained in the mean LKS score in both groups as (p-value≤0.05).

Table 1: Demographic Profile of patients underwent two surgical Intervention (n=600)

n(%) or Mean±S.D

Characteristics		Open ACL (n=500)	Arthroscopic Reconstruction (n=100)	p-value
Gender	Male Female	465(93) 35(7)	89(89) 11(11)	0.2136
Age (mean+SD)		30.27+_ 4.2	29.57+_ 4.7	0.1366
Duration of follow up		12	12	

Table 2: Functional outcome of Patientsusing LKS score among two Groups(n=600)

n(%)

	Group 1 Open ACL		Group 2 Arthroscopic ACL		
Outcome	n=500	**Mean±S.D**	**n=100**	**Mean±S.D**	**p-value**
Excellent	450(90)		55(55)		
Good	20(4)	82.78 ±14.78	30(30)	90.88±13.22	*0.021
Fair	20(4)		10(10)		
Poor	10(2)		5(%)		

**p-Value≤0.05 considered to be significant*

IV. Discussion

Open ACL reconstruction and arthroscopic reconstruction are not new as lots of literature is available about these two but the debate regarding which approach is better is still going on.[9]In this retrospective analysis, our objective was to compare LKS scores following ACL reconstruction and arthroscopic reconstruction, and comparing with each other.

Overall, 92.3% of the patients in our findings were male. It has been a well established fact that male population is more exposed to road accidents and outdoor activities,[10,11] this could be the major reason why significantly more male are reported involving reconstruction procedures.

Quite a few systems have been developed in the recent years evaluating pre as well as post operative condition of knee area. Different protocols are available but most are based on functional as well clinical evaluations. O'Donoghue is known to be the 1st to apply scale system aiming to evaluate post operative results.[12] Our objective was to compare the post operative outcome of ACL reconstruction and arthroscopic reconstruction in knee injuries based on follow up (at least 1 year). Various methods were considered aiming to evaluate knee region. We got attracted to Lysholmknee scaling (LKS) score which is based on the modified Lysholm protocol and has been used extensively all around the world. LKS has also been noted to have high reliability, validity as well as responsiveness all over the world.[13-17] This was the very

reason that we adopted this scale and we are confident that translating results using such scale will further benefit larger proportions of our population.

In the present study, open ACL patients, mean LKS was noted to be 82.78 with a standard deviation of 14.78 whereas in arthroscopic reconstruction group, mean LKS was noted to be 90.88 with a standard deviation of 13.22 while the difference between the two groups was statistically significant. In a recent study conducted by L. de Villiers[18] to find out the prevalence of osteoarthritis in the knee in the long term after ACL reconstruction, 43 patients were evaluated as per LKS. Mean KLS score was noted to be 84.35 in those patients. These results are very similar to our findings where we noted mean KLS score to be 82.78 in our patients.

A study done by Kose O et al[11] noted the mean LKS score to be 93.56 which is close to what we found in the present study. Overall mean follow up in that study was recorded to be 33.4 months which is quite higher in comparison to what we had in our findings. While comparing, open ACL reconstruction and arthroscopic reconstruction group, mean LKS was noted to be significantly higher in arthroscopic reconstruction patient showing overall better results of following this technique.

V. Conclusion

Majority of our patients were male. Although both studied procedures got good overall LKS but patients following arthroscopic reconstruction had significantly better LKS in comparison to open ACL reconstruction.

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Translation and Cross-Cultural Adaptation of the Harris Hip Score into Arabic

By Dr. Awdhah Al-Samhan, Dr. Owayed Al-Mutairi, Dr. Abdulaziz Al-Kudair & Dr. Aliaa Khaja

Abstract- *Background:* The Harris Hip Score (HHS) is a widely used Patient-Related Outcomes score. It measures pain and function levels in patients with hip pathologies.

Objectives: The main objective of this study is to translate and culturally adapt the HHS into Arabic, and to assess the reliability and validity of the translated version.

Material & Methods: 110 patients participated in this survey. The internal consistency tests were calculated using Cronbach's alpha. Test-retest reliability (intra-correlation coefficient), convergent construct validity, convergent validity, floor & ceiling effects, and responsiveness were calculated. Bland-Altman Plot and forest plots were done to measure the level of agreement.

Results: Test reliability for the first testing situation - calculated using Cronbach's alpha - was 0.98 for the pain subscale, 0.98 for the stiffness, and 0.99 for the physical function subscale. For the second testing, reliability was 0.99, 0.97, and 0.99 (pain, stiffness, and physical function, respectively).

Keywords: *harris hip score, modified, total hip replacement, validity, reliability.*

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

Strictly as per the compliance and regulations of:

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Conclusion: Overall, the Arabic version of HHS is used as a diagnostic tool for patients with hip problems, when it comes to information about the overall condition of the patient, especially about the improvement or deterioration. However, one must be cautious using HHS when the change magnitude of the patient's condition is being investigated since there is a potential probability that the patient's level of improvement will be overestimated by HHS.

Keywords: harris hip score, modified, total hip replacement, validity, reliability.

I. Introduction

Patient-Related Outcomes (PROs) have emerged as useful tools for measuring medical conditions, has have been proven to be extremely useful in musculoskeletal disease clinics.[1] These well-structured questionnaires are completed by patients to reflect their own perspective.[2,3]. Hip pain is a prevalent complaint, in which both the patient and the clinician could benefit from utilizing a PRO to monitor conditions and decide on a management approach.[4-5] The Harris Hip Score is a widely used tool that combines the clinician's input with the patient-reported symptoms to generate a better clinical picture of the hip pathology at hand and evaluate treatment options.[6] The questionnaire itself, however, is in English. Healthcare services in Arabic speaking countries would not be able to use it; hence, the need for a cross-cultural adaptation of the score. The authors of this study aim to prove the validity and reliability of the Arabic version of this score.

II. Methods and Materials

a) Translation

We did the translation as per recommendations of Guillemin's guidelines for validation and cross-cultural adaptation [9] after permission obtained from the original HHS copyright holder. Two Bilingual orthopedic surgeons were responsible for the conceptual and literary translation of the original version. Two other versions were produced by independent translation companies with a background in scientific English. All the versions produced were similar. Modifications to incorporate from all the versions were made and implemented in the final version. A professional Arabic grammar checker reviewed it. The back-translation came close to the original score. A pilot test was then conducted on ten random patients from the arthroplasty clinic. This was done after the approval of the Arabic version by the translation committee. Both the physicians interviewed the patients after completing the questionnaire to address any issues or need for assistance.

b) Participants

One hundred ten patients completed the Harris Hip Score questionnaire and agreed to have their data analyzed for research purposes. The average age of the participants was 44.3 years, with a standard deviation of 15.4 years, implying that the majority of the sample was between 30 and 60 years of age. The youngest participant was 16, and the oldest was 76 years of age.

c) Psychometric Properties and Data Analysis

For all of the analyses, IBM SPSS Statistics 21 was used.

To estimate the reliability of the questionnaire we calculated Cronbach's alpha, and since every patient

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completed the survey on three different occasions, Cronbach's alpha was calculated for each of the three test situations. Also, we used the ICC (interclass correlation coefficient) to assess test-retest reliability.

Content validity was tested by examing the shape of data distribution, as well as floor and ceiling effects. The floor effect is the percentage of patients who scored the lowest possible score (score of 0), and the ceiling effect is the percentage of those with the highest score (score of 100). If more than 30% of the respondents had the floor or ceiling effect, the effects are considered to be relevant.

To test the convergent validity of HHS, we calculated Spearman's correlation coefficient between HHS and WOMAC. Since WOMAC has already been validated in Arabic speaking countries, the higher correlation coefficient would prove the convergent validity of the HHS. Nonetheless, it is worth noting that a higher score on WOMAC indicates a greater disability, while patients with a lower disability will have a low HHS score. This means that to have HHS validated, we are to expect a negative correlation between the score on WOMAC and HHS.

d) Questionnaires

Harris Hip Score

The HHS usually contains 12 questions covering four domains: pain, function, deformity, and range of motion. The questions are answered using a Likert scale, with the final score having a maximum of 100 points (best possible outcome), and a minimum of 0 points (extreme symptoms). The 100 points are shared into subdomains - pain receives 44 points, function 47 points, range of motion 5 points, and deformity 4 points; function is split into activities of daily living (14 points) and gait (33 points). A total HHS of <70 points are considered as poor results, 70 to 80 is fair, 80 to 90 is good, and 90 to 100 is excellent (Nilsdotter and Bremander, 2011). For this study, a modified HHS (subtracted from the deformity and range of motion subdomains) is used. Hence, the possible range for this instrument is not from 0 to 100, but from 0 to 91. What this means is that the ceiling effect was documented for those patients who had scored 91 points.

All 110 patients have completed HHS on at least two different occasions (T1 and T2), and 109 of them completed a third time (T3). There were two and a half weeks between each of these three occasions.

e) Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC)[8]

24 Likert-type items make this WOMAC and using it, every patient gets three scores from three different subscales. First subscale – pain – has five questions (score range 0-20), two questions address stiffness (score range 0-8), and physical function has 17 questions (range 0-68). A 0 score on each of the subscales means that the patient has not felt any discomfort in his/her hip (if any); on the other hand, a higher score suggests a higher disability.

The survey was done on two different occasions, and two weeks had passed between the two testing situations.

III. Results

a) WOMAC questionnaire

WOMAC has been validated in Arabic speaking countries and has since been employed in clinical practice. Nevertheless, we did additional analyses to explore the psychometric characteristics of a WOMAC questionnaire that was used in this study.

Test reliability for the first testing situation - calculated using Cronbach's alpha - was 0.98 for the pain subscale, 0.98 for the stiffness, and 0.99 for the physical function subscale. For the second testing, reliability was 0.99, 0.97, and 0.99 (pain, stiffness, and physical function, respectively). This is proof that WOMAC is a reliable instrument.

To check content validity, we examined floor and ceiling effects. 10% of the patients have recorded floor effect on pain subscale, 14% on stiffness subscale, and 12% on the physical function. On the other hand, 3% have recorded ceiling effects on the pain subscale, 3% on stiffness subscale, and 3% on the physical function. Being that these percentages are far less than 30% (which is considered relevant) – this is an argument in favor of the content validity of WOMAC.

Harris Hip Score

To test the reliability of the instrument, we calculated Cronbach's alpha. For each of the three testing occasions the reliability was very good or excellent – $\alpha_1 = 0.92$, $\alpha_2 = 0.91$, and $\alpha_3 = 0.90$. The intra-class correlation coefficient was good with a score of 0.76 (95% CI 0.44-0.88).

We recorded floor effect for 1% of the patients, and 2% showed a ceiling effect in the first week of testing. Two and a half weeks later, 1% of respondents again showed the ceiling effect, and there was no floor effect recorded. On the third testing, 1% recorded the floor effect, and an additional time ceiling effect was not documented. We checked whether the data had deviated significantly from the normal distribution using the Shapiro-Wilk test. The result showed that it did, in all three testing occasions.

Table 1: Descriptive statistics of the Harris Hip Score questionnaire

		N[1]	Min[2]	Max[3]	Mean	SD[4]	Sk[5]	Ku[6]	Floor effect	Ceiling effect
HHS	Week 1	110	0	91	66.0	17.613	-1.232	1.494	1%	2%
	Week 2	110	0	87	61.1	17.841	-1.024	.692	1%	0%
	Week 3	108	0	85	52.6	18.563	-.565	-.015	1%	0%

Note: [1] Sample size; [2] Minimum; [3] Maximum; [4] Standard deviation; [5] Skewness; [6] Kurtosis.

We applied a 2-week test-retest reliability of HHS to the present manuscript. Of the 110 patients that fulfilled the questionnaire, 108 responded to the second assessment after the initial evaluation.

Table 2: Mean, Standard Deviation, Change, ICC between different assessments of each subscale

Subscales	Scores						Change*	ICC (95% CI)	Cronbach's alpha (95% CI)
	First assessment		Second assessment		Third assessment				
WOMAC	Mean	SD	Mean	SD	Mean	SD			
Pain	53.22	15.90	63.17	18.85			9.95	0.581 (0.234 - 0.760)	0.735 (0.379 - 0.864)
Stiffness	53.38	16.87	63.55	18.50			10.17	0.593 (0.230 - 0.772)	0.745 (0.375 - 0.872)
Physical Function	53.31	16.39	62.91	18.60			9.60	0.623 (0.262 - 0.793)	0.768 (0.416 - 0.884)
HHS	72.55	19.35	67.12	19.61	57.81	20.40	-14.74	0.755 (0.442 - 0.876)	0.902 (0.704 - 0.955)

** Minus sign in HHS means that the condition of the patient has been worsened over time (lower score = Deterioration) / Plus sign in WOMAC means that the condition of the patient has been worsened over time (higher score = Deterioration)*

Test-retest reliability was performed using Intra-class Correlation (ICC). The results (Table 2) indicated that HHS has an acceptable intra-class correlation with 0.755 (95% CI 0.442, 0.876). Considering the value of 0.902 (95% CI 0.704 – 0.955) for Cronbach's alpha, the internal consistency of the three assessments were proven to be very high.

To be able to compare the results of the WOMAC questionnaire with those from HHS, it was necessary to standardize the scores of WOMAC to the range of 0-100. Also, the HHS scores, which were in the range of 0-91, were rescaled to 0-100 to match the WOMAC scores. Figure 1 illustrates the change and the mean level of different subscales during different assessments which were conducted two weeks apart from each other. It is visually evident that the mean score of HHS decreased, which is related to more pain and symptoms. At the same time, the WOMAC mean score is showing an upward trend, which is also related to more pain, and in general, worsened conditions of the patient. This illustrates a visual agreement between the two questionnaires.

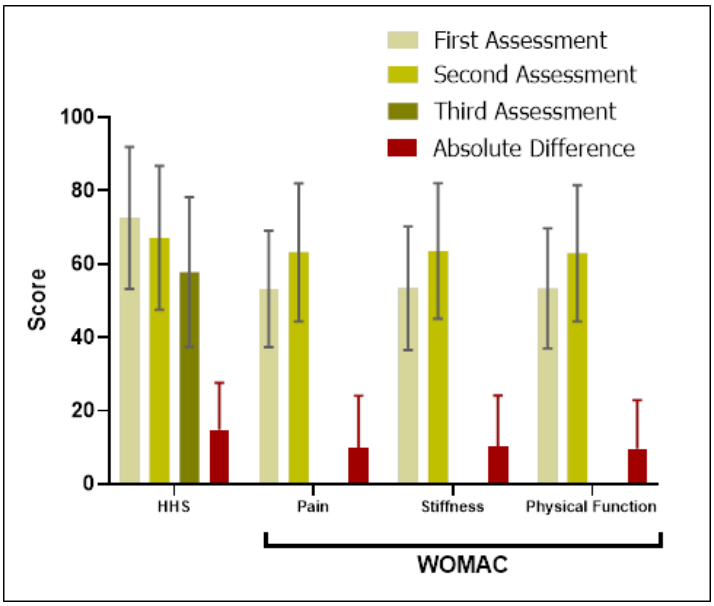

Figure 1: The mean score and the absolute difference along with their standard deviations during 3 different assessments for HHS and two assessments for the WOMAC questionnaire. Decrease of the mean score in HHS & Increase of mean score in WOMAC = worsened condition

As illustrated in the table below, there are medium to large negative correlations between Harris Hip Score on one side, and all the subscales from the WOMAC questionnaire on the other. It shows that patients with high scores on WOMAC have low scores on HHS. It, therefore, means that those who experience more severe hip pain have higher scores on WOMAC, and lower HHS.

Table 2: Convergent validity of the Harris Hip Score (Spearman's rank correlation coefficient)

	WOMAC		
	Pain	Stiffness	Physical function
Week 1			
Harris Hip Score	-.56**	-.61**	-.62**
Week 2			
Harris Hip Score	-.41**	-.42**	-.48**

*Note: ** Correlation is significant at the 0.01 level (2-tailed).*

b) Responsiveness

Fourteen patients (13.1%) reported overall relevant improvement in their condition by responding to the WOMAC questionnaire, while 53 patients (49.5%) reported worsening of their condition, and 40 of participants remained stable (37.4%).

Table 3: Responsiveness and agreement between the two questionnaires

QUESTIONNAIRES		HARRIS HIP SCORE (HHS)			TOTAL
		Stable	Improvement	Deterioration	
WOMAC	Stable	3.7%	2.8%	30.8%	37.4%
	Improvement	0.0%	2.8%	10.3%	13.1%
	Deterioration	3.7%	0.9%	44.9%	49.5%
TOTAL		7.5%	6.5%	86.0%	100.0%

On the other hand, only eight patients (7.3%) reported remaining stable by responding to the HHS questionnaire. The majority of them (86.4%) believed their condition to deteriorate, and only 6.4% of them reported relevant improvement after 2 weeks. Also, it is worth noting that twelve patients (11.2%) showed contradictory results (one patient improved according to HHS, and worsened according to WOMAC, while eleven patients showed the opposite). Thirty-three patients (30%) believed that their condition had aggravated according to HHS, while according to the WOMAC, their condition was not changed (Table 3).

Table 4: Effect Sizes and SRMs for the WOMAC subscales and HOOS subscales. Bars represent the 95% confidence intervals

Questionnaire	Subscales	Effect Size (Cohen's d)	95% CI*		SRM	95% CI*	
WOMAC	Pain	0.571	0.387	0.751	0.406	0.358	0.434
	Stiffness	0.574	0.395	0.749	0.411	0.366	0.436
	Physical Function	0.547	0.378	0.709	0.410	0.363	0.434
HHS		0.729	0.537	0.891	0.456	0.441	0.467

** Bootstrap confidence interval (1000 iterations; random number seed: 978).*

Effects are often used to give meaning to change over time in terms of 'trivial' (ES < 0.20), 'small' (ES ≥ 0.20 < 0.50),'moderate' (ES ≥ 0.50 < 0.80) or 'large' (ES≥ 0.80) change. Cohen introduced this 'matched pairs' effect size, which was later renamed the standardized response mean (SRM) by Liang et al.[20] According to responsiveness test, WOMAC subscales show similar responsiveness (SRM = 0.41) between first and second measurement. In comparison to WOMAC, HHS showed better responsiveness with SRM = 0.46. It is important to note, however, that responsive change of both questionnaires are very similar and the differences are not considerable.

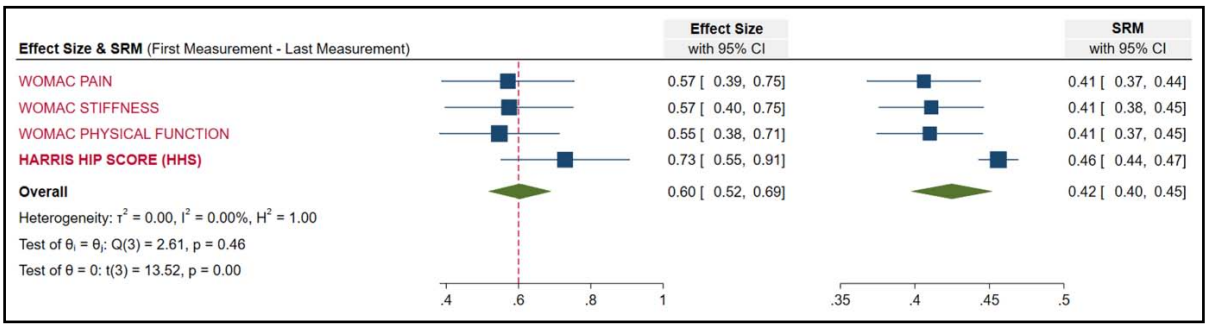

Figure 2: Forest Plot of Effect Sizes and SRMs for the WOMAC subscales and HHS. Bars represent the 95% confidence intervals

c) Level of Agreement between WOMAC & HHS

One of the best methods to measure the level of agreement between the two measurement methods is the Bland-Altman plot. In this method, the mean difference between WOMAC and HHS is plotted as a function of the mean of WOMAC and HHS. As shown in the graphs, the overall mean difference between WOMAC and HOOS shows that there could be a systemic bias between two questionnaires (M = -7.49, 95% CI -13.59, -1.41, p = 0.016). To test this result, linear regression was performed with a mean difference between WOMAC and HOOS as a dependent variable and a mean value of WOMAC and HOOS as an independent variable. The result of linear regression also indicates statistically significant difference between the two measurement methods (β = -0.94, 95% CI -1.801 – -0.081, t = -2.168, p = 0.03).

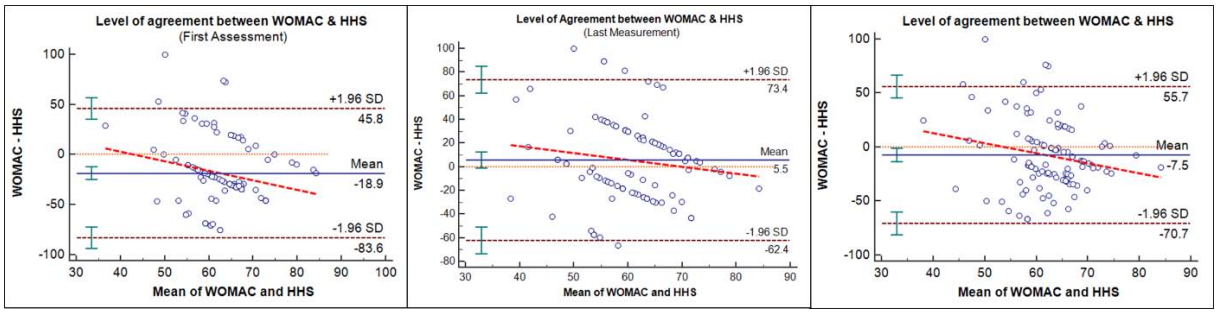

Figure 3: Bland-Altman Plot to demonstrate the level of agreement between HHS and WOMAC (First, last, and average assessments). The linear regression line is also drawn to better demonstrate the systemic bias between the two methods

The first and last measurements of both methods are also compared together with the help of the Bland-Altman plot, to investigate whether there will be any change over time to the systemic bias between the two methods. The results indicate that in the first measurement there is a systemic bias between the two methods (M = -18.9, 95% CI -25.13, -12.65, $p < 0.001$), the performed linear regression also confirms this bias (β = -0.95, 95% CI -1.81 – -0.104, t = -2.235, p = 0.028). It means that HHS increasingly overestimates the worsened conditions in comparison to WOMAC. However, in the last measurement, the slope of the regression line decreases and became statistically insignificant (β = -0.58, 95% CI -1.38 – 0.23, t = -1.429 p = 0.156).

IV. Discussion

The primary objective of this study was to create a reliable and valid Arabic version of HOOS by translation and adaptation. For this purpose, the Arabic version of HHS is compared to the efficacy and results of the WOMAC questionnaire. Preliminary validity and reliability tests revealed that there is a moderate reverse correlation between WOMAC subscales and HHS, which indicated that they are related in the right direction, since their scores are in the opposite directions (0 for WOMAC = no pain / 0 for HHS = extreme pain).

However, according to Altman and Bland's views regarding the correct analysis of the data gathered in studies of this type, it is not enough to use the correlation coefficient between the two measurements as a measure of agreement[18]. They pointed out that methods can correlate well yet disagree greatly, as would occur if one method read consistently higher than the other. For this reason, the Bland-Altman Plot was used to measure the level of agreement between WOMAC and HHS. The Bland-Altman plots indicated that there is a systemic bias between WOMAC and HHS. And the linear regression illustrated that with an increasing mean score, the Arabic version of HHS tends to underestimate the results of WOMAC. According to McGrory et. al.[19], Differences in scores between hips were highly correlated for HSS and WOMAC total score, HHS pain, and WOMAC pain subscores, and HHS function and WOMAC physical function subscores. However, they found out that WOMAC stiffness and HHS range of motion were not significantly correlated. Overall, they concluded, that patients with bilateral hip arthroplasty can apply the WOMAC osteoarthritis index questions to individual hips at the same time as effectively as the joint-specific HHS questions. The illustrated forest plots, and effect sizes, showed that HHS scores were generally higher than WOMAC scores. In general, the results of both methods lead the surgeon to the right direction when it comes to information about the overall condition of the patient, especially about the improvement or deterioration, however, it is important to be cautious using HHS when the change magnitude of patient's condition is investigated since there is a potential probability that the level of improvement of the patient's condition will be overestimated by HHS.

The major outcome of this study is that the HSS Arabic version demonstrated high levels of validity and reliability of evaluated patient-reported outcomes of Arabic patients with a range of hip pathologies. The patients did not encounter any difficulty in completing the questionnaire. An evaluation of the internal consistency showed that Cronbach's α coefficient for the HSS Arabic version was within the recommended range of values [10], the implication being that the questionnaire items were nonredundant as well as homogenous. The Arabic version of the HSS appears to have an excellent test-retest reliability (ICC, 0.755), compared to data reported in previous literature [11]. Hinman et al reported lower test-retest reliability with a 0.76 ICC value which corresponds with ours [12]. Interval of time between repeat measurements is a vital issue to be considered when determining the reliability of test-retest. According to the literature, the estimation of HSS test-retest reliability ranges from 7-14 days, and three weeks to a month [11, 12]. If patients are given short-retest intervals, then there is the risk of them getting over-familiar with the questions, while answers given will depend on their potential to recall the answers in the first assessment. Although this possibility is decreased by

longer intervals, one may observe a spontaneous improvement of acute complaints. Generally, there should be a very short period between repeat administrations of outcome measures reported by the patient, when the condition being measured is expected to undergo a rapid change. The test was repeated seven days after the initial assessment. Hinman et al did a ~7.5-day interval retest for the hip patients (7-14 days), which corresponds with our study [12].

Celik et al.[21] sought to translate and culturally adapt the HHS into Turkish, and thereby determine the reliability and validity of the translated version. Celik et al translated the HHS into Turkish per Beaton-recommended stages. 80 patients were tested by the HHS. The Turkish version of the HHS showed sufficient internal consistency (Cronbach's alpha, 0.70) and test-retest reliability (ICC = 0.91) compared to the Arabic version which had test-retest reliability of 0.755 [11]. The Turkish study' correlation coefficients between the WOMAC & the OHS and the HHS were 0.89 and 0.64 respectively [21]. The highest correlations between the HHS and SF-36 were with the physical function scale (r = 0.72), and the lowest correlations were with the mental function scale (r = 0.10). Celik et al. observed no floor or ceiling effects.

The literature has reported several validity tests. Studies conducted recently have sought to investigate the validity of the HHS by determining the link that it has with other outcome measures reported by patients, such as the Total Functional Score [13], the WOMAC [11, 14], and the Nonarthritic Hip Score [15]. Our study provided evidence for construct validity by establishing the link between the Arabic versions to the WOMAC. The Arabic version of the HHS and the WOMAC had a very good construct validity (r = 0.67), which corresponded with that in previously documented data [12, 16].

Evidence for discriminate validity and convergent validity was provided. We determine what links existed between the eight scale scores and the HHS and 2 summary scores of the SF-36. Of course, the HHS had a strong relationship with concurrent measures of physical function compared to concurrent measures of mental function. We found the lowest correlation value between the HHS and mental domains of the SF-36 (r = 0.014). This demonstrates that the SF-36 measures additional aspects of physical health and provides more comprehensive, but less specific, information about a patient's overall health than do condition-specific questionnaires.

V. Conclusion

The primary purpose of this study was to create a reliable and valid Arabic version of HHS by translation and adaptation. Its reliability - calculated both through Cronbach's alpha and ICC - was good or moderate. Although the distributions for all subscales deviate from a normal one, no significant ceiling or floor effects were observed.

The Arabic version of HHS is short and easily administered and interpreted with minimal investment of time required for both the researcher and clinician. We believe that the Arabic version of the HHS is sufficient to evaluate the state of a Hip disease. Its levels of reliability and validity are acceptable and we believe that it will facilitate the assessment of functional limitations and symptoms experienced by Arab-speaking individuals with a variety of hip disorders. There is a need for further studies to assess the responsiveness and to determine the minimum clinically relevant differences in the Arabic version of the HHS for common Hip pathologies.

Declarations

Ethical approval and Consent for publication

- Ethical approval was obtained
- Consent of publication was obtained in writing from all participants
- Name of Ethical Committee: Ministry of Health, Kuwait, Research and publication office
- Committee Reference Number: 0096524622226, 0096524622230

Consent to publish

Consent of participation and publish was obtained with written Format from all participants.

Availability of data and material

The data that support the findings of this study are available from [ministry of health Al-raze hospital, Kuwait] but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. Data are however available from the authors upon reasonable request and with permission of [ministry of health Al-Razi hospital, Kuwait].

Competing interests

The authors declare that they have no competing interests.

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Authors' Contributions

The data collection and the writing were done by all the four authors equally.

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Not applicable

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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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