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SURGERIES AND CARDIOVASCULAR SYSTEM

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# Ascending Colon Duplication- A Case Report with Review of Literature

By Guru Prasad Painuly, Col. Ashok Tyagi, Rashk Kaushal & Mini Singhal

*Max Super Specialty Hospital*

**Abstract-** Gastro – intestinal duplications are usually detected in children before 2 years of age due symptoms/complications associated with the condition or during surgery in the child for some unrelated condition. In adults colonic duplication is of rare occurrence and often diagnosed during surgery. However, it may be diagnosed pre operatively due to symptoms of obstruction, volvulus or rarely due to perforation. We present an adult having tubular duplication of ascending colon, that presented with perforation. The duplication had a blind end and did not have distal communication. In addition, it had its own blood supply. The management of the case is discussed. Aetiogenesis of the anomaly is enumerated and literature reviewed.

For ascending colon duplication similar meaning word accessory ascending colon has also been used in the manuscript.

**Keywords:** gastro – intestinal tract duplication, colonic duplication, tubular duplication of colon.

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# Ascending Colon Duplication- A Case Report with Review of Literature

Guru Prasad Painuly <sup>α</sup>, Col. Ashok Tyagi <sup>σ</sup>, Rashk Kaushal <sup>ρ</sup> & Mini Singhal <sup>ω</sup>

**Abstract-** Gastro – intestinal duplications are usually detected in children before 2 years of age due to symptoms/complications associated with the condition or during surgery in the child for some unrelated condition. In adults colonic duplication is of rare occurrence and often diagnosed during surgery. However, it may be diagnosed pre operatively due to symptoms of obstruction, volvulus or rarely due to perforation. We present an adult having tubular duplication of ascending colon, that presented with perforation. The duplication had a blind end and did not have distal communication. In addition, it had its own blood supply. The management of the case is discussed. Aetiology of the anomaly is enumerated and literature reviewed.

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## I. INTRODUCTION

Gastro-intestinal duplications are uncommon anomaly. The incidence has been reported as 1 per 4500 births by the various authors<sup>1</sup>. Due to complications of acute abdomen or bowel obstruction, most cases (65-80%) are detected in children by the age of 2 years<sup>2,3,4,5,6,7,8</sup>. This is the reason that most cases have been reported in children and a few number of cases have been reported in adults. Amongst gastro – intestinal duplication colonic duplication represents only 7 – 20% cases<sup>2,3</sup>. Fotiadis et al stated that most of the time definitive diagnosis of colonic duplication is made during a laparotomy<sup>6</sup>.

The differential diagnosis includes enteric cyst, giant colonic diverticulum, volvulus colon, duplication cyst. If not diagnosed in childhood, then these anomalies may come to notice in the later life as a chance finding (being asymptomatic) during an unrelated surgery. When associated with symptoms of intestinal obstruction, volvulus or compression of normal

adjacent bowel by the expanding blind end duplication<sup>6,9</sup>. It may also present with symptoms and signs of diverticulitis<sup>10</sup>. Rarely in case of presence of ectopic gastric mucosa with ulceration bleeding or perforation may occur<sup>9,10</sup>. The relative occurrence of digestive duplication has been reported as follows<sup>2,11</sup>. – jejunum 8%, Ileal 30%, ileocecal valve 30%, colon 6-7%, rectum 2-3%. The complications of colonic duplication include development of adenocarcinoma, squamous carcinoma and carcinoid tumour<sup>12,13,14</sup>. For a true digestive duplication, Rowling has set forth the following criteria<sup>15</sup> –

1. The wall of duplication should be in continuity with one of the duplicated organs.
2. The cyst is surrounded by a smooth muscle layer.
3. A layer of digestive mucosa is present (Typical or Heterotrophic).

Examples include gastric/colonic/pancreatic

## II. CASE REPORT

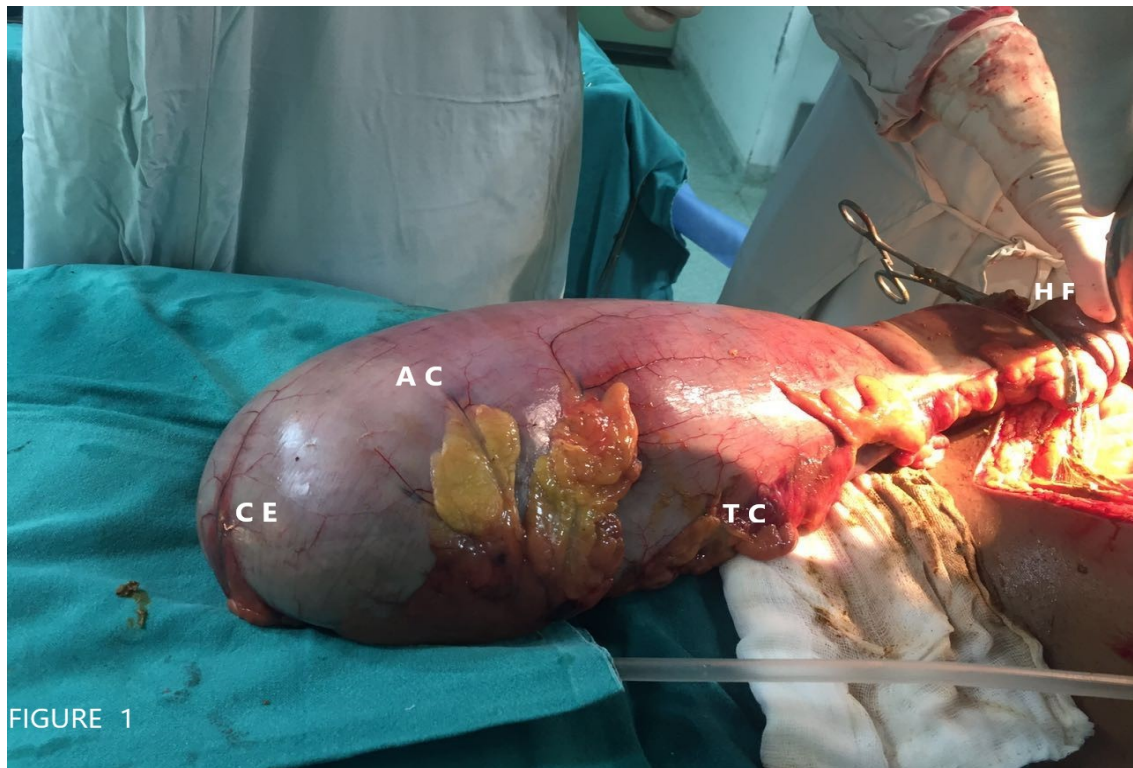
A 45 Year aged male was brought to ER as a case of acute abdomen. He had severe pain in abdomen, abdominal distension and h/o obstipation. He had signs of intestinal perforation. A bed side U/S and Xray abdomen erect (in sitting position) revealed free air under dome of diaphragm and also shadow of colonic lump. The findings were suggestive of intestinal perforation. Patient did not consent for CT abdomen, and hence with a presumptive diagnosis of volvulus sigmoid colon with perforation emergency exploratory laparotomy was done. Exploration revealed a free 40 cm long segment of colon that originated proximal to hepatic flexure. The duplicated ascending colon had a blind end distally, that reached pelvic brim. It was grossly distended and there was a big perforation at its origin from the primary colon (Figure 1, 2 and 3). The ascending colon was excised from proximal to origin of duplication along with right colonic flexure. Both colonic ends were closed and a side-to-side hand sewn anastomosis was done. A covering proximal loop ileostomy was formed for temporary diversion. Patient had postoperative sepsis and had a prolonged hospital stay of 21 days. 4 months later uneventful ileostomy closure was done.

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AC: Accessory ascending colon, TC: Taenia coli

*Figure 1:* Long duplication of ascending colon with distal free blind end.



VS: Vascular supply, C: Confluence of taenia in accessory ascending colon

*Figure 2:* Separate arterial feeder of accessory ascending colon.





HF: Hepatic flexure, Transverse colon with colonic band is also visible.

Figure 3: Hepatic flexure with big proximal perforation at the junction of ascending and accessory ascending colon.

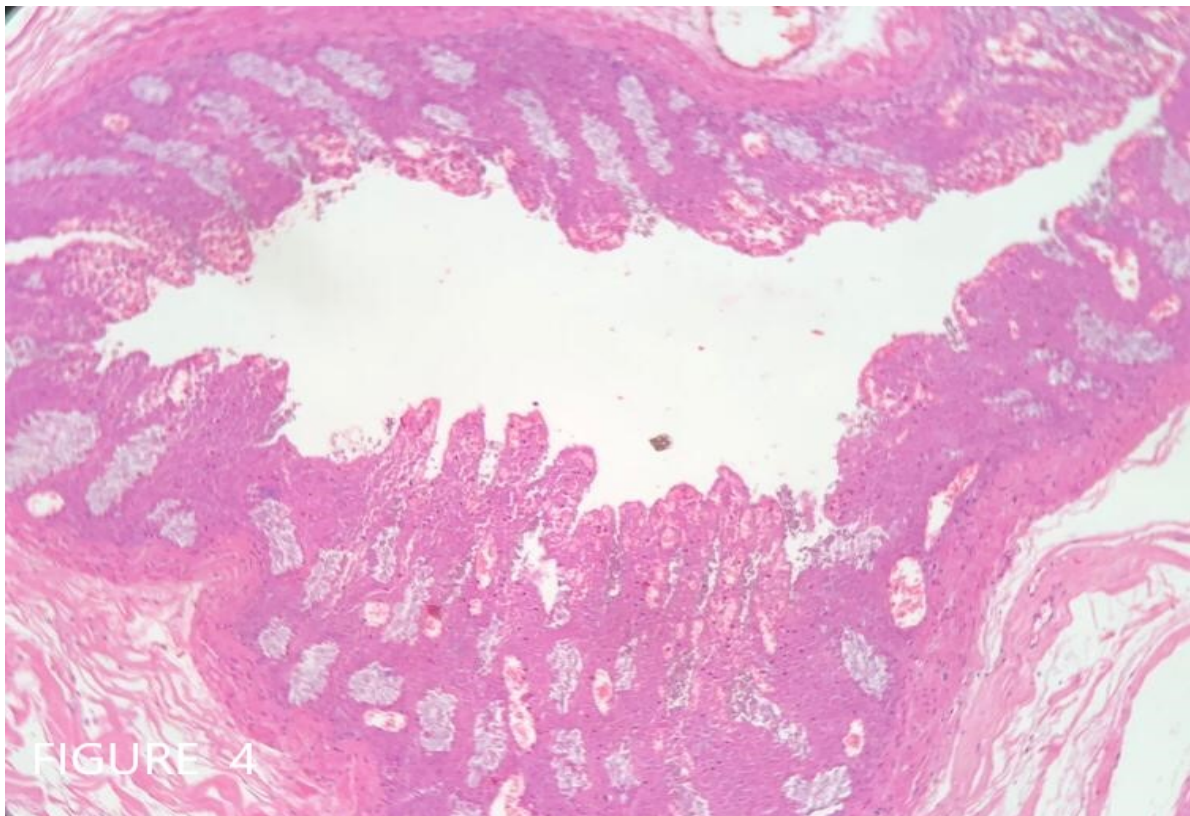


Figure 4: Histo-biopsy of the excised accessory ascending colon

### III. DIAGNOSIS AND MANAGEMENT

Sonography, CT scan, Contrast enema and Colonoscopy have been suggested for the diagnosis<sup>16</sup>. Contrast CT is best modality in diagnosis, however preoperative diagnosis is difficult<sup>17</sup>. In addition, MRI and Contrast MRI have also been used in the diagnosis of colonic duplication.

Surgical resection of duplication with attached normal colonic segment to avert the risk of developing cancer in the duplicated colon is recommended<sup>2,3</sup>. Currently laparoscopic resection of colon duplication has been advocated<sup>18,19,20</sup>. Laparoscopic surgery is a preferred approach in the management of gastro-intestinal duplications<sup>21</sup>. In huge barrel shaped colonic duplication selective mucosal excision with preservation of sero-muscular layer or distal internal drainage by excision of the common wall of duplication may be an effective alternative<sup>2,3,5,22</sup>.

### IV. AETIOGENESIS, CLASSIFICATION AND REVIEW OF LITERATURE

Historically first case of colonic duplication was reported in 1733 by Cadler<sup>23</sup>. Another case was described by Suppinger in 1876, and the term 'duplication of alimentary tract' was first coined by Ladd in 1937. The exact cause of colonic duplication remains unknown, however environmental factors like trauma and hypoxia etc. have been implicated in its formation<sup>24</sup>. Lewis et al proposed the diverticular theory, whereas alterations in closure of embryonic disc have been attributed as the cause of colonic duplication by others. Yet another theory regarding colonic duplication was proposed by Smith. It describes dorsal protrusion of yolk sac caused by its herniation or adherence to ectoderm responsible for the condition. This theory explains the Genito-urinary problems associated with duplication of hindgut. However, the most plausible theory having comprehensive explanation is given by Bremer. It states aberrant lumen recanalization of the gut in the embryo as the cause of colonic duplication. Since the duplication develops within the intestine, the outer wall contains all tissue layers and its counterparts<sup>25</sup>.

Colonic duplications are difficult to differentiate from Mc Nutt's type 3 or Choony and Frizell's type 2 giant diverticulum<sup>8,26</sup>. Gross et al described 4 varieties of duplication<sup>4</sup> –

1. A tubular structure that branches out from intestine and extends for some distance between mesenteric leaves.
2. A double barrel structure communicating with the intestine lumen at one or both ends.
3. A cystic structure lying in the peritoneal cavity attached by a mesenteric stalk.

4. A spherical lesion contiguous with some part of the bowel particularly along the ileum.

Tubular Duplication can be barrel type or T/Y shaped.

McPherson classified colonic duplication into 3 groups<sup>27</sup>–

Type I Simple cyst

Type II Diverticulum

Type III Tubular colonic duplication

Stern et al reported that 80% colonic duplications are cystic type, and 20% cases are tubular<sup>5</sup>.

Another classification envisages length/extent of involvement of colon/bowel. 2 Types are described –

*Type I* is limited to colon or rectum and is usually partial. If these lesions project into the lumen of bowel, patient may have intussusception leading to obstruction<sup>5,28</sup>.

*Type II* duplications most of the time involve entire colon and are associated with genital or lower urinary tract anomalies. These may also be associated with intestinal mal rotation, duplication of ileum and appendix, spinal anomalies, omphalocele, exstrophy of urinary bladder and other abdominal wall anomalies. Double barrel duplication is usually associated with distal anomalies, terminal fistula or imperforated anus (type IIb and c). These duplications communicate with the bowel proximally, and in most cases do not have distal communication. Thus, these may become distended with faecal matter and cause obstruction of the adjacent bowel<sup>29,30</sup>. Patient may have pain due to over distension or inflammation. Due to ulceration of the aberrant mucosa present in the duplicated segment, gastro-intestinal bleeding may occur<sup>4</sup>. Unless associated with another congenital anomaly, duplication having a distal communication are usually asymptomatic. Usually, duplication is present along the ante mesenteric border of bowel, whereas it is lateral in position in case of ascending colon. Transverse colon duplications occur along supra colic margin. Rectal duplications occur posterior to rectum and both have common mesentery and blood supply, however loop duplication have a separate mesentery and blood supply. Tubular duplications sometimes can have direct communication with perineum<sup>3,30</sup>. Tubular type of colonic duplication (T or Y type) have only one communication with the native bowel and the other end forms a blind pouch (as in our present case). Sometimes the distal end may communicate distally forming perianal and Genito-urinary fistula and imperforated anus<sup>20</sup>.

Due to number of cases being small, literature has mostly case reports rather than large series or multi-institutional series. Rarely complete duplication of colon may occur<sup>29,30</sup>. Reporting cases from 1950 – 2005, Fotiadis C et al reported total 83 cases<sup>6</sup>.

Roberts M et al reported 2 cases of sigmoid duplication that were pre operatively misdiagnosed as carcinoma<sup>7</sup>. Historically a case of colonic triplication has



been reported by Gray, A.W.<sup>31</sup> Lee KH et al reported laparoscopy for the first time in the management of intestinal duplication in a child<sup>32</sup>. A case of asymptomatic tubular duplication of transverse colon has been reported by Kim YW et al<sup>33</sup>. 2 Cases of colonic duplication that presented as rectal bleeding have also been reported by Fotiadis C et al<sup>6</sup>. 7 case reports of colonic duplication in adults were also reported. Of these 4 patients presented as abdominal pain and 3 had intestinal obstruction<sup>34</sup>. A 'Y' shaped colonic duplication has been reported by Chang et al<sup>35</sup>. A. Sozutek et al reported a case of perforated caecal duplication cyst presenting as peritonitis<sup>36</sup>. An adult female had a sigmoid colon duplication, that was pre-operatively diagnosed as colonic diverticula<sup>8</sup>. Jung Hi et al have reported a complete tubular duplication of colon in adult female with Colo-vaginal fistula<sup>37</sup>. Wu X et al also reported a case of tubular colonic duplication in an adult<sup>38</sup>. Another anomaly presenting with multi segmental asymptomatic duplication of colon has been reported<sup>39</sup>. Kung-Chuan Cheng et al reported a case of colonic duplication that presented as a huge abdominal mass in an adult female<sup>40</sup>. Yet another case of colonic duplication cyst in adult female has been reported by Shrestha S and Adhikari S<sup>41</sup>. Li GB et al managed a case of tubular colonic duplication and published it<sup>42</sup>. Recently Reddyn V et al reported a case of intestinal duplication in an elderly male that presented as sigmoid volvulus<sup>43</sup>.

## V. TAKE HOME MESSAGE

Diagnosis of colonic duplication should be suspected in an adult with chronic colicky pain with constipation as the condition may get unrecognized till adulthood. Patient may also have abdominal lump, distension- usually chronic in nature. However rarely it can also present as acute emergency. The pre-operative diagnosis may be difficult without radiological investigations because of vague clinical and radiological presentation. Treatment is to admit the patient and do open or laparoscopic resection of duplication along with attached normal colonic segment.

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# Clinical Pattern and Outcomes of Neck Vascular Injuries at Aden Hospitals

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**Abstract- Introduction:** Vascular trauma to the neck can result in life-threatening injuries, because it contains a high concreteness of vital organ structures. Therefore, trauma require prompt diagnosis and treatment.

**Objectives:** To identify the different clinical pattern and outcome of traumatic neck vascular injury in Aden hospitals during 2015 – 2017.

**Patients and methods:** A retrospective observational study of all patients admitted to hospital with traumatic neck vascular injuries (TNVIs) between 2015 -2017. Data was collected about demographics, pattern of injury, type of vascular injury, associated injuries, hospital stay, and mortality rate.

**Keywords:** *traumatic neck vascular injuries, penetrating injuries, clinical presentation.*

**GJMR-I Classification:** NLMC Code: WG 170



*Strictly as per the compliance and regulations of:*



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**Abstract- Introduction:** Vascular trauma to the neck can result in life-threatening injuries, because it contains a high concreteness of vital organ structures. Therefore, trauma require prompt diagnosis and treatment.

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**Patients and methods:** A retrospective observational study of all patients admitted to hospital with traumatic neck vascular injuries (TNVIs) between 2015 -2017. Data was collected about demographics, pattern of injury, type of vascular injury, associated injuries, hospital stay, and mortality rate.

**Results:** Of the total 52 TNVIs patients, male were 98.1 %. The mean age was  $28.63 \pm 10.07$  years. The majority of injuries were penetrating (96.2%); gunshot was the predominant mechanism of injury (75%). Injuries in zone II involved in (57.7%). Of the TNVIs (65.4%) were associated with other injuries most of theme aerodigestive tract injury (38.2%). Patients presented with small non-pulsatile hematoma (28.8%), external bleeding (26.9%), rapid expanding hematoma (25%), neurological deficit (13.5%) and palpable thrill-audible bruit (5.8%). There is significant difference between stability of patients and their presentation ( $P= 0.033$ ), most of stable patients have small non-pulsatile hematoma (43.3%), whereas an unstable patients have rapid expanding hematoma (36.4%). Neck exploration was performed in (94.2%). Arteries were more prone to injury (72.2%) than veins (28.8%). The common carotid artery is the commonest affected carotid arteries (41.5%), followed by external carotid artery (14.6%) and vertebral artery (12.2%). The internal jugular vein was the commonest injured vein (61.9%). Among those patients managed operatively; (55.9%) of injuries were repaired while ligation was performed on (44.06%). Complications were encountered in (50%) of them (42.3%) neurological deficit, wound infection (3.8%), fistula and hoarseness (1.9% for each). Overall mortality rate was (19.2%). Most of deaths occurred when patients were unstable during presentation ( $p<0.012$ ).

**Conclusion:** TNVIs represent an alarming serious entity. Dominant presentation is penetrating injuries, exclusively among young male, mainly exposed to gunshot wound. The need for operative intervention should be based on clinical features. Moreover, further researches and an institutional protocol guidelines management are requested.

**Keywords:** traumatic neck vascular injuries, penetrating injuries, clinical presentation.

## 1. INTRODUCTION

The neck is a vulnerable area comprising different vital organs of multiple physiological systems. Due to juxtaposition of these anatomical structures, there is a high predisposition of multi-systemic injuries with potentially life threatening lesions of the major blood vessels that concenter most common injured structure.<sup>1-3</sup>

TNVIs represent 5-10% of all severe trauma cases<sup>3-5</sup>. The neck is a complex anatomical area because in a small space there are abundant critical aerodigestive, neurological, and vascular structures.<sup>6</sup> over the neck injury does not usually occur in isolation, therefore trauma are potentially dangerous and require prompt diagnosis and treatment.<sup>6</sup>

Mostly injured components in cervical trauma related to vascular structures.<sup>7</sup> The most common mechanism is penetrating injury which mostly involved the common carotid artery, while the vertebral artery was less common injured due to its anatomical position.<sup>2,8-10</sup> High velocity penetrating trauma can cause secondary injuries "blunt trauma" by shock wave.<sup>10</sup> The major venous injuries seen after penetrating trauma are the internal jugular vein and external jugular vein, in such cases venous injuries are never recognized due to its lower pressure.<sup>11</sup>

Vascular injury is suggested by history and physical examination. Patient clinical presentation and symptoms still hold an important place in the management of penetrating neck injuries (PNIs), patients with signs of significant neck injury, particularly those with "hard" signs of vascular and/or aerodigestive injuries, require immediate surgical exploration.<sup>12</sup>

When an arterial injury is identified during neck exploration, current consensus agrees that primary repair of the artery is preferred than ligation, irrespective of any abnormality in focal preoperative neurologic examination findings.<sup>13</sup> Optimal management of patients with PNIs remains a controversial issue.<sup>2</sup> The treatment strategy of PNIs acquired from military surgical practice suggested mandatory exploration as a standard treatment to avoid missed injuries. However, civilian adoption of mandatory exploration in PNIs resulted in high negative exploration rate.<sup>12</sup> Therefor in the last three decades, there has been a slow shift towards selective

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management for these injuries, which using zones of neck to guide investigations and management a “zone-based” approach or “no zone” approach.<sup>13-15</sup> Injuries are classified by penetration site into the three anatomical zones.<sup>14,16</sup> Those patients should be evaluated using proper physical examination, selective use of investigations<sup>17,18</sup> and managed according to staff experience and resource availability.<sup>14</sup>

Ideally, war injuries should be treated by surgeons having military surgery experience. In fact, civilian surgeons may find themselves trapped in wars practicing military surgery without prior training or experience in this field.<sup>19</sup> The purpose of this study was to review our experience with penetrating neck vascular injuries in Aden-Yemen, thereby focusing on surgical management, and early outcomes and to highlight lessons learned from that period.

## II. METHOD AND PATIENTS

This retrospectively study was conducted at Department of surgery in four main hospital in Aden city from 1st of April 2015 up to 31st December 2017. All patients of both gender and any age who fulfilling the inclusion criteria were enrolled in this study. During study period, the total number of patients admitted to surgical department in relation to vascular neck injury in Aden Hospitals were 52 patients. Any of the following was considered criteria for exclusion: death before admission, patients with superficial wound (which defined by injuries superficial to the plan of the platesma) or patients with minor neck injury who did not require hospital admission.

All patients were resuscitated in emergency room according to Advanced Trauma Life Support protocols in the hospital field. The clinical diagnosis was done at the time of the admission by history taking, physical examination and investigations (laboratory, radiological and ultrasound), and/or confirmed during operative intervention.

The variable was collected retrospectively using a questionnaire and interviewing the patients including: age, sex, residence, clinical presentations that include detailed history of the injuries, hemodynamic status, external bleeding, expanding or large haematoma, neurological deficit and palpable thrill / audible bruit, associated injuries, operative finding, treatment option, and outcomes. Types of morbidity included neurological deficit, wound infection, A-V fistula and hoarseness.

*Data and statistical analysis:* data were presented as a proportion, medians or mean  $\pm$  standard deviation as a appropriated and the analysis will be covered out using SPSS version 22 (SPSS Inc., Chicago, IL, USA). Quantitative variables like age and duration of symptoms were presented by calculating means  $\pm$  standard deviation (SD). Qualitative variables like gender, symptoms and operative finding were

presented by calculating frequencies and percentages. The statistical significance of differences between categorical variables were calculated by the chi-square test, Fisher's exact test. P-value of  $<0.05$  was considered as statistically significant.

## III. RESULTS

During the study period from April 2015 to December 2017, the total number of patients with neck vascular injury was 52 patients. Most of the patients were male (98.1%). The age ranges from 9 to 60 years with a mean age was  $28.63 \pm 10.07$  years. The peak age of patients with neck vascular injury in this study was in second decade (46.2%) followed by the third decade (26.9%) of life.

The majority of injuries was penetrating (96.2%); gunshot was the predominant mechanism of injury (75%), followed by sharp object injury (15.4%). Stab wound and road traffic accidents represent (3.8%) for each, and iatrogenic injury (1.9%). About (76.9%) of patients presented within the first 6 hours to the hospital and (42.3%) of the patients were unstable at the time of presentation. More than half of patients had their injuries on the right side; and the same percentage of injury in zone 2, while 17% of the studied patients had their injury in multiple zones. Concerning presentation of patients, the highest percentage of them presented with small non pulsatile hematoma (28.8%), followed by external bleeding (26.9%) and pulsatile hematomas (25%). Table I

In our study, we found arteries were the commonest injured vessel (71.2%), followed by veins (28.8%). Concerning type of injury, the most common finding was partial cut (55.9%), complete cut (44.1%). The commonest injured vessel is the carotid arteries, the common carotid artery represent (41.5%), followed by external carotid artery (14.6%) and vertebral artery in (12.2%), whereas the internal jugular vein was the most common vein injured (61.9%). Fig.1,2

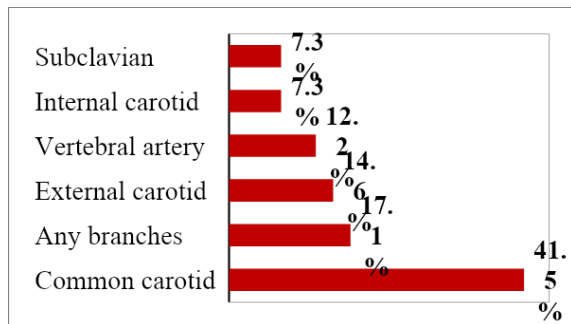
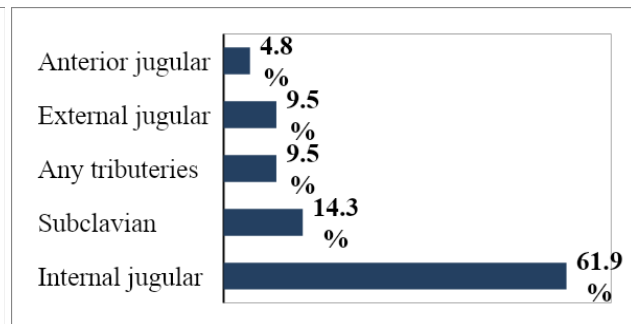
About two third of our patients had another associated injuries, the most common associated injuries were aerodigestive tract injury (38.2%), followed by brachial plexus injury (23.5%).

The operative intervention was the main therapeutic option for most patients it represent (94.2%) and only (5.8%) of patients managed by non-operative procedures. Among those managed operatively, repair was performed in most of them (55.9%), while the ligation performed in (44.06%). The common type of repair was simple anatomical repair that represent (51.5%) followed by using graft in (33.3%) and end-to-end anastomosis in (21.2%) of patients.



*Table 1:* Clinical presentations of patients with neck vascular injury (n=52)

Variables			No.	%
Mechanism of neck vascular injury	Penetrating		50	96.2
	Type of penetrating	Gunshot	39	75.0
		Sharp object	8	15.4
		Stab wound	2	3.8
		Iatrogenic	1	1.9
Time of presentation (hrs)	Blunt		2	3.8
Time of presentation (hrs)	< 6		40	76.9
	≥ 6		12	23.1
Hemodynamic state	Stable		30	57.7
	Unstable		22	42.3
Site of injury	Right		30	57.7
	Left		20	38.5
	Bilateral		2	3.8
Zone of injury	zone 1		6	11.5
	zone 2		30	57.7
	zone 3		7	13.5
	Multiple zone		9	17.3
Presentation	Small non pulsatile hematoma		15	28.8
	External bleeding		14	26.9
	Rapid expanding hematoma		13	25.0
	Neurological deficit		7	13.5
	Palpable thrill / Audible bruit		3	5.8

*Figure 1:* Name of Injured arteries: (n=42)*Figure 2:* Name of injured vein: (n=17)

Our study showed that neck vascular injury in the hospitals are associated with (19.2%) mortality. Complications were found in (50%) patients with vascular neck injury. The most common complications was the neurological deficit (42.3%), while wound infection, A-V fistula, and hoarseness occur in (3.8%), (1.9%) and (1.9%) of patients respectively. The hospital stay ranged from one to more than 15 days. About (50%) of the studied patients stay in hospital 1-7 days, while (40.4%) stay 8-14 days and (9.6%) of them stay more than 15 days, as shown in Table II.

Table II: Outcome of the studied patients with neck vascular injury

Variables		No.	%
Morbidity	No	26	50.0
	Yes	26	50.0
Type of morbidity	Neurological deficit	22	42.3
	Wound infection	2	3.8
	A-V fistula	1	1.9
	Hoarseness	1	1.9
Hospital stay (days)	1- 7	26	50.0
	8- 14	21	40.4
	>15	5	9.6
Mortality	No	42	80.8
	Yes	10	19.2

#### IV. DISCUSSION

This study deliberate the first study in Yemen, could be due to the lack of national data. Therefore, we conducted this retrospective descriptive study to establish the frequencies of clinical patterns and the outcomes of TVNI<sub>s</sub> in population of Aden hospitals within two consecutive years; from 1<sup>st</sup> April 2015 up to 31<sup>st</sup> Dec 2017.

Analysis of the personal characteristics of patients in this study showing a high prevalence of TNVIs among young males (98.1%), being similar to the studies reported by *Martinakis et al<sup>1</sup>* in Athens and *Reva et al<sup>2</sup>* in Russia.

The peak age for TNVIs in this study was in the second decade (46.2%) follow by third decade of life (26.9%). Similar observation was reported in other studies.<sup>1,3</sup>

More than half of the patients in this study were solidier (65.4%) while the incidence of traumatic injuries in Civilian (34.6%), showing a similarity to studies performed by *White et al<sup>20</sup>* and *Rasmussen et al<sup>21</sup>* reports that civilian traumatic injuries of neck vessels are relatively uncommon.

The predominant mechanism of injury to the neck in this study is PNIs; (75% gunshot, 15.4% sharp objects and 3.8% stab wound) with a percentage of (96.2%), which is consistent with almost all other studies.<sup>1,6,13,22</sup> The blunt injuries are rare and consist (3.8 %) of studied patient as demonstrated by other studies.<sup>3,15</sup>

Findings at emergency department are small non pulsatile hematoma (28.8%), external bleeding (26.9%), rapid expanding hematoma (25.0%), neurological deficit (13.5%) and palpable thrill-audible bruit (5.8%), nearly similar result found by *Reva et al<sup>2</sup>* report cases on Physical examination reviled non pulsatile hematoma (36%), active bleeding from neck wound (19.6%), expanding or large hematoma in the injured area (19.6%), neurological deficit (17.4%), and asymptomatic injury (15.2%), while *Teixeira et al<sup>19</sup>* reports external Bleeding (64%), expanding hematoma

(22%), and *Nasr et al<sup>23</sup>* reviled (65.5%) of the sample had active bleeding and (17.2%) hematomas.

In these study, commonest injured vessel were arteries it represent (71.2%), veins injury reviled (28.81%) this is in agreement with previous reports, where *Prichayudh et al<sup>17</sup>* report 36 patients underwent immediate neck exploration, identified (55.6%) arterial injuries, (19.4%) venous injury, *Bodanapally et al<sup>17</sup>* report 51 patient, (76.5%) patients had arterial injuries,<sup>(116)</sup> in contrast to another study by *Ghnnam et al<sup>6</sup>* that report commonly affected anatomical structures were the neck veins (24.5%), followed by neck arteries (10.2%). However other studies were reported venous injury more than arteries injury.<sup>24,25</sup> These differences may because majority of jugular venous injuries are probably unrecognized without exploration owing to the low-pressure venous system.<sup>22</sup>

In current study, a higher proportion of TNVIs had associated injuries (65.4%), while (34.6 %) of patients had isolated neck trauma. *Biffi et al<sup>26</sup>* demonstrated similar incidence of associated injuries (33.1%). The most common associated injuries were aerodigestive tract injury (38.2%) similar to *Pirrelli et al<sup>27</sup>*, in this study brachial plexus represent (23.5%), spinal injury represent (14.7%), and facial injury (11.8%).

Our study shows that, the operative intervention was the therapeutic option for most patients it represent (94.2%), only (5.8 %) were managed by conservative management. One study report neck exploration was performed in (88.2%) in his series while other demonstrated (84.4%) surgical intervention.<sup>3,22</sup>

In this series 49 patients, underwent exploration, for positive physical examination findings and workup, this is supported by a study by *Thomas et al<sup>28</sup>* published a prospective study in which complementary diagnostic studies were used based on physical examination findings and no CTA was performed, showing good results. Furthermore, *Mahmoodie et al<sup>22</sup>* and his group demonstrated that physical examination did not miss any major vascular or esophageal injuries that required intervention.

Among those managed operatively, repair was performed in most of them (55.9%) whereas the ligation performed in (44.06%). The common type of repair was simple repair that represent (51.5%) follow by using graft (33.3%) and end-to-end anastomosis (21.2%). One study established surgical interventions mainly included simple repair (53%).<sup>3</sup>

In the studied hospitals patients are treated with primary repair for carotid artery regardless of the degree of consciousness depression and preoperative condition similar to was found in *Pirrelli et al*<sup>27</sup> study. Other author recommend repair for CAI only in the absence of severe neurologic deficit. The overall mortality rate was (19.2%) this is high compared to other studies, in which mortality rates ranged from (11.8%) as *Al Thani et al*<sup>4</sup> as well *Ghnnam et al*<sup>6</sup> (12.2%).

The hospital stay ranged from one to more than fifteen days. About (50.5%) of the studied patients stay 1–7 days, while 8–14 days represent (40.4%) and (9.6%) they stay more than 15 days. *Ghnnam et al*<sup>6</sup> proved the mean duration of hospital stay 6.6 days; it is similar to this series.

Complications found in (50%) of the studied patient's. The common complications were the neurological deficit (42.3%), wound infection (3.8%), while A-V fistula and hoarseness (1.9%) for each, similar finding was reported by *Reva et al*.<sup>2</sup>

## V. CONCLUSION

TNVIs represent an alarming serious entity. Dominant presentation is penetrating injuries, exclusively among young male, mainly exposed to gunshot wound. The need for operative intervention should be based on clinical features. Moreover, further researches and an institutional protocol guidelines management are requested.

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## Evaluation of Blood Elements and Red Blood Cell Indices among Sudanese Cannabis and Cigarette Smokers in Khartoum State

By Dr. Abdelgadir Ahmed Abdelgadir, Alaa Ibrahim Mohammed, Abeer Saifaldeen Basher & Dr. Amged Hussein Abdelrahman

**Abstract- Background:** Cannabis, also known as (marihuana), is a psychoactive drug from the cannabis plant used for medical or recreational purposes. It is one of the most commonly used psychoactive drug worldwide, and it is the most popular illegal drugs. Long-term use of cannabis has acute effects on hemostasis of the body and hematological parameters of addicted individuals. Cigarette smoking is one of the major leading causes of death throughout the world: smoking has both acute and chronic effects on hematological parameters; many studies proved its harmful effects on many organ systems, mainly respiratory, reticuloendothelial system, and cardiovascular systems. Tobacco cigarette smoking is one of the main leading causes of death worldwide. Continuous cigarette smoking has severe adverse effects on hematological parameters (e.g., hemoglobin, white blood cells count, mean corpuscular volume, mean corpuscular hemoglobin concentration, red blood cells count, hematocrit).

**Keywords:** *cannaibs; cigarette cannaibs smokers, hematological parameters.*

**GJMR-I Classification:** *NLMC Code: QW 300*



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**Abstract- Background:** Cannabis, also known as (marihuana), is a psychoactive drug from the cannabis plant used for medical or recreational purposes. It is one of the most commonly used psychoactive drug worldwide, and it is the most popular illegal drugs. Long-term use of cannabis has acute effects on hemostasis of the body and hematological parameters of addicted individuals. Cigarette smoking is one of the major leading causes of death throughout the world: smoking has both acute and chronic effects on hematological parameters ; many studies proved its harmful effects on many organ systems , mainly respiratory, reticuloendothelial system , and cardiovascular systems. Tobacco cigarette smoking is one of the main leading causes of death worldwide. Continuous cigarette smoking has severe adverse effects on hematological parameters (e.g., hemoglobin, white blood cells count, mean corpuscular volume, mean corpuscular hemoglobin concentration, red blood cells count, hematocrit). These represented a predisposing factor for the development of various pathological conditions and diseases such as atherosclerosis, polycythemia vera, chronic obstructive pulmonary disease and cardiovascular diseases.

**Objectives:** This work aimed to study the effect of Cannabis abuse and cigarette smoking on some hematological parameters in Sudanese smokers.

**Methodology:** This study was an observational comparative cross-sectional community-based study that enrolled a total of hundred Sudanese participants, divided into fifty (50) Sudanese individuals smoking cannabis plants as a case group and fifty (50) non-smoker healthy Sudanese individuals as a control group. Venous blood samples was collected from each participant, and a Complete Blood Count (CBC) was carried out using an automated hematology analyser to measure the hematological parameters for both groups.

**Results:** The result stated that the levels of total leukocyte count (WBCs), hematocrit (HCT), Neutrophils absolute count, and Red Cell Distribution Width (RDW) were significantly higher in cannabis smokers as compared to non-smokers with P.values equal (0. 001), (0. 005), (0.04) and (0. 000), respectively. The study revealed a significant decrease in platelet count and lymphocyte percentage count with P.values equal (0.04) and (0.02), respectively. The study also show significant effect of long-term smoking of cannabis among the case group in reducing the level of (HCT) with P.value (0.04).

This study concludes that the rates of examinations among cigarette smokers compared to non-smokers state a significantly higher values of Mean Corpuscular Volume (MCV) ( $p<0.0362$ ) Platelet Distribution Width (PDW) ( $P<0.025$ ) and its significance in WBCs depending on duration ( $p<0.0419$ ) and depending on the dose ( $p<0.0473$ ).

**Conclusion:** This study indicated that cannabis abusing could change the hematological parameters; therefore, the indiscriminate use of them should be discouraged as it is detrimental to the body results of our study conclude that there is a significant increase in MCV and PDW among smokers. But there was no change in other CBC parameters. Also, results conclude that smoking duration and frequency significantly increase white blood cell count.

**Keywords:** cannaibs; cigarette cannaibs smokers, hematological parameters.

## I. INTRODUCTION

Marijuana also known as (Cannabis) or Cannabis Sativa, is a psychoactive drug from the cannabis plant used for medical and recreational purposes (1). It is one of the most commonly used psychoactive drugs worldwide, and it is one of the most popular illegal drugs (2). Main psychoactive part of cannabis is tetrahydrocannabinol, which has a scientific name called "Cannabinoids and Cannabidiol. Cannabinoids are usually classify as endocannabinoids, phytocannabinoids, and synthetic cannabinoids. Synthetic cannabinoids are in the gathering of drugs called new psychoactive substances and these technically synthetic cannabinoid receptor agonists are designer drugs that mimic the psychoactive effects of cannabis (3). There is a long tradition of cannabis use for culinary, medicinal and ,ceremonial purposes in many developing countries. Various intake routes of tetrahydrocannabinol THC (intravenous, smoke, inhalation and, oral) so can be used by smoking, vaporizing, in food, or an extract. The plasma levels are related to onset, degree and duration of clinical effects. The degree of response and plasma cannabinoid levels attain edvary in a dose-related manner depending upon the potency of smoked marihuana(4). Over the last decades, there have been considerable researches involving cannabinoids and their importance in regulating a variety of physiological

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and psychological processes such as pain, feeding behavior, lipid metabolism, pleasure sensation, and immune system (4). The physical harm caused by cannabis is less well-known. In adults, chronic bronchitis, lung cancer, myocardial infarction, hepatotoxicity, decreased sperm count and motility, gynecomastia in males, suppression of ovulation among females, low birth weight and delayed visual system, and development among the newborns of cannabis using females (3). Plant-derived cannabinoids include delta-9-tetrahydrocannabinol (THC), the primary psychoactive component of cannabis. Cannabinoids mediate their effects through binding specific receptors, which are members of the G protein-coupled receptor superfamily. Two cannabinoid receptors was identified: Cannabinoid-1 receptor (CB1) and cannabinoid-2 receptor (CB2). CB1 is expressed primarily in the central nervous system (CNS) and is responsible for the psychoactive effects of cannabinoids by modulating neurotransmitter release). In contrast, CB2 is localized primarily in immune cells such as lymphocytes, macrophages, and neutrophils and is responsible for the immunomodulatory effects of cannabinoids (5). Smoking is the most important health problem in the world. Many studies proved its harmful effects on many organ systems like respiratory, reticuloendothelial system, and cardiovascular systems. (6) Tobacco cigarette smoking is one of the main leading causes of death worldwide. Continuous cigarette smoking has severe adverse effects on hematological parameters (e.g., hemoglobin, white blood cells count, mean corpuscular volume, mean corpuscular hemoglobin concentration, red blood cells count, hematocrit). These represented a predisposing factor for the development of various pathological conditions, and diseases such as atherosclerosis, polycythemia vera, chronic obstructive pulmonary disease and cardiovascular diseases. (7) Smoking effects on hematological indices observed on routine complete blood count testing (CBC). Smoking- induced increased in red blood cell count (RBC) was described. Current smoking has been reported as an associative factor with leukocytosis (TLC), thrombocytosis (PLTS) in some reports. Nicotine-induced JAK-STAT &NF-Kb signaling pathways are thought to mediate the increase in RBC. (8)

## II. MATERIALS AND METHODS

**Study population:** Sudanese voluntary cannabis abusers and Cigarette smokers in Khartoum state, Sudan.

**Inclusion criteria:** This study included Sudanese voluntary cannabis abusers and Cigarette smokers in Khartoum state, Sudan.

**Exclusion Criteria:** The Participant with any disease or smoking any other type of smoking was excluded.

**Data collection:** Collected using self administrated per coded questionnaire, which was specifically designed to obtain information to this study.

**Blood sampling:** Venous blood was collected using sterile disposable plastic syringes after cleaning the venous puncture area with 70% ethanol, the blood 2.5 ml was added to the anticoagulant container EDTA.

**Methods:** The result was calculated by CBC analyzer. Whole blood is passed between two electrodes through apertures so narrow that only one cell can pass through at a time.

**Statistical Analysis:** Statistical assessment was carried out with statistical package for social sciences (SPSS) version 17.0 for windows statistical software.

**Ethical Considerations:** All participants were voluntarily submitted written informed consent before the commencement of the study. Neither the participant name nor situation or any other information was used in this study.

## III. RESULTS

A total of 100 Sudanese participants were enrolled in our research, divided into 50 Sudanese individuals smoking cannabis plants as a case group and 50 healthy Sudanese individuals as a control group. (Fig.1). All study participants were males with ages ranged from (17) to (35) years old in both groups. (Fig.2). Concerning some other Cannabis smoking characteristics, the majority of cases group 38 (76%) reported smoking duration more than three years and almost nearly all of them, 49 98%, reported smoking frequencies of more than five times per week as detailed in figure (3), and Table (1). In regards to the effect of cannabis smoking on the results of complete blood count test results, our study showed that measures of cases group were significantly higher among cases group compared to the control group in white blood cells count ( $p = 0.0121$ ), HCT ( $p = 0.0055$ ), neutrophil count ( $p = 0.0428$ ) and in RDW – SD ( $p = 0.004$ ). The study showed that measures of the cases group were significantly lower among case group compared to control group in platelets count ( $p = 0.0477$ ), and in the Lymphocytes count ( $p = 0.0238$ ) as detailed in the table (2). Lastly, the study did not find a significant difference in the complete blood count measures according to the duration of cannabis smoking among the case group except in hematocrit ( $p = 0.041$ ) as detailed in Table (3) the study was not able to assess the effect of cannabis smoking frequency/week of the measures of complete blood count because of the lack of variation in the relevant data; because all most all 49 (98%) of the case group had a similar frequency of weekly cannabis smokers. Among the cigarette smokers this study showed that the majority, 36 72% of the cases group (smokers) were within the age group 20 – 25, as

detailed in Table (4). Concerning some other smoking characteristics, more than half of cases group 27 (54%) reported smoking cigarette duration less than five years, and almost the majority of them, 40 80% reported smoking frequencies less than ten times per day as detailed in Tables 5 and 6. In regards to the effect of cigarette smoking on the results of complete blood count measures, our study showed that results of cases group were significantly higher among cases group compared to control group in mean cell volume ( $p =$

0.0362), in PWD ( $p = 0.0259$ ) as detailed in Table (7). Moreover, the study did not find a significant difference in complete blood count measures according to the duration of smoking among case group except in white blood cells count ( $p = 0.0419$ ) as detailed in Table 8. This study did not find a significant difference in complete blood count measures according to the frequency of smoking among case group except in white blood cell count ( $p = 0.0473$ ) as detailed in Table (9).

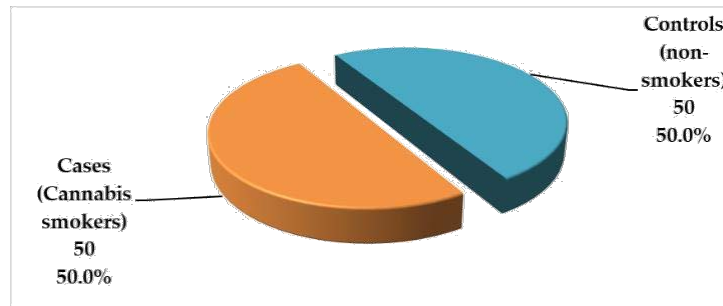


Figure. (1): The distribution of the study participants according to the study groups.

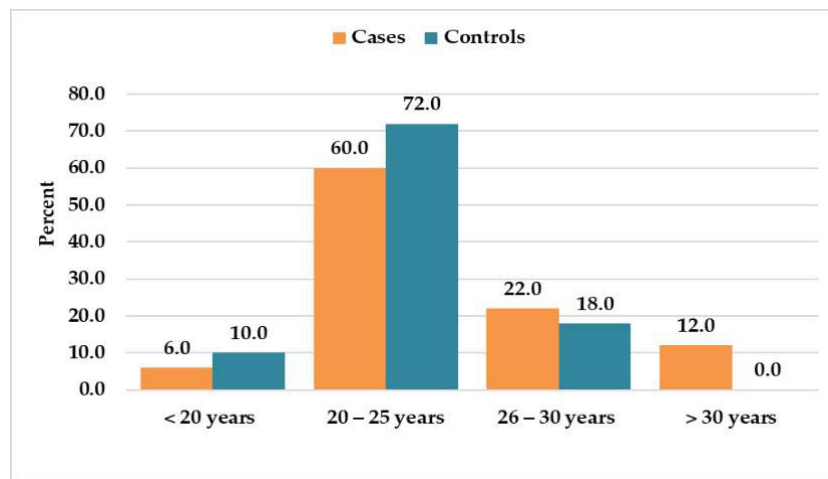


Figure. (2): The distribution of the study participants according to their age in years.

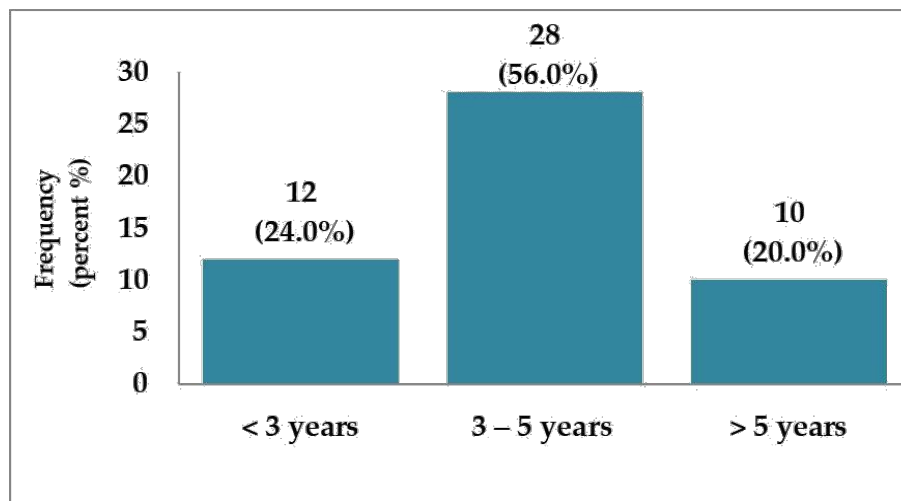


Figure. (3): The distribution of the study participants according to their cannabis smoking duration in years (n = 50 cases).

**Table (1):** The distribution of the study participants according to their cannabis smoking frequency per week (n = 50 cases).

Cannabis smoking frequency – week	Frequency	Percent (%)
< 5 times / week	1	2.0
> 5 times / week	49	98.0
Total	50	100.0

**Table (2):** The difference in complete blood count results between the study groups (n = 100, 50 cases + 50 controls).

Complete blood count	Study groups		Difference	P value
	Mean in Case	Mean in Control		
WBC ( $\times 10^3$ )	6.26	5.20	1.07	<u>0.0121</u>
RBC ( $\times 10^3$ )	5.45	5.24	0.21	0.3539
HGB (g/dL)	14.36	14.04	0.32	0.4234
HCT (%)	46.62	43.29	3.33	<u>0.0055</u>
MCV (fL)	84.48	82.15	2.33	0.2855
MCH	27.78	26.95	0.83	0.1231
MCHC (g/L)	35.19	32.68	2.51	0.4774
PLT ( $\times 10^3$ )	237.06	269.44	-32.38	<u>0.0477</u>
LYM ( $\times 10^3$ )	2.22	2.15	0.07	0.7814
NEUT( $\times 10^3$ )	2.50	1.88	0.63	<u>0.0428</u>
MIX ( $\times 10^3$ )	1.16	1.13	0.03	0.8482
LYM (%)	35.88	42.08	-6.20	<u>0.0238</u>
NEUT (%)	39.18	36.35	2.83	0.4033
MIXD (%)	18.91	20.20	-1.29	0.6402

RDW-SD (%)	44.73	42.41	2.31	<u>0.0004</u>
RDW-CV (%)	13.58	14.11	-0.53	0.0833
PDW (%)	16.85	15.80	1.05	0.0819
MPV (fL)	11.20	10.95	0.26	0.6012
P-LCR (fL)	27.14	27.33	-0.19	0.8557
PCT (ng/ml)	0.25	0.29	-0.03	0.0777

Table (3): The effect of Cannabis smoking duration on the measures of complete blood count (n = 50 cases)

Complete Blood Count (CBC)	Duration of Cannabis smoking (years)			Overall mean	P value
	< 3	3 - 5	> 5		
WBC ( $\times 10^3$ )	6.36	6.20	6.33	6.26	0.967
RBC ( $\times 10^3$ )	5.35	5.23	6.17	5.45	0.241
HGB (g/dL)	14.75	14.19	14.38	14.36	0.692
HCT (%)	50.41	45.61	44.91	46.62	<u>0.041</u>
MCV (fL)	81.68	84.24	88.51	84.48	0.236
MCH	27.67	27.64	28.32	27.78	0.577
MCHC (g/L)	46.02	31.72	31.91	35.19	0.163
PLT ( $\times 10^3$ )	243.17	228.04	255.00	237.06	0.792
LYM ( $\times 10^3$ )	2.32	2.02	2.65	2.22	0.676
NEUT( $\times 10^3$ )	2.04	2.59	2.82	2.50	0.327
MIX ( $\times 10^3$ )	1.14	1.14	1.25	1.16	0.776
LYM (%)	36.23	33.11	43.21	35.88	0.374
NEUT (%)	35.08	40.25	41.12	39.18	0.391

MIXD (%)	20.18	18.31	19.07	18.91	0.811
RDW-SD (%)	45.10	44.77	44.15	44.73	0.525
RDW-CV (%)	14.26	13.19	13.88	13.58	0.582
PDW (%)	16.31	16.85	17.51	16.85	0.309
MPV (fL)	12.83	10.55	11.08	11.20	0.177
P-LCR (fL)	25.95	27.39	27.86	27.14	0.379
PCT (ng/ml)	0.28	0.23	0.28	0.25	0.923

*Table (4):* The distribution of the study participants according to their age - years (n = 50 cases)

Age – years	Frequency	Percent (%)
< 20 years	5	10.0
20 – 25 years	36	72.0
26 – 30 years	9	18.0
Total	50	100.0

*Table (5):* The distribution of the study participants according to their smoking duration - years (n = 50 cases)

Smoking duration – years	Frequency	Percent (%)
< 5 years	27	54.0
5 – 10 years	19	38.0
> 10 years	4	8.0
Total	50	100.0

*Table (6):* The distribution of the study participants according to their smoking frequency - day (n = 50 cases)

Smoking frequency – week	Frequency	Percent (%)
< 10 cigarettes / day	40	80.0
≥ 10 cigarettes / day	10	20.0
Total	50	100.0

*Table (7):* The difference in complete blood count results between the study groups  
(n = 100, 50 cases + 50 controls)

Complete blood count	Study group		Difference	P value
	Case	Control		
WBC ( $\times 10^3$ )	5.38	5.10	0.28	0.3340
RBC ( $\times 10^3$ )	5.24	5.22	0.02	0.7970
HGB (g/dL)	14.06	13.91	0.15	0.5760
HCT (%)	43.08	42.48	0.60	0.3547
MCV (fL)	82.61	77.20	5.41	<u>0.0362</u>
MCH (pg)	27.04	26.84	0.20	0.6957
MCHC (g/L)	32.69	32.67	0.02	0.9353
PLT ( $\times 10^3$ )	263.86	278.52	-14.66	0.3274
LYM ( $\times 10^3$ )	2.20	2.10	0.09	0.4726
NEUT ( $\times 10^3$ )	0.73	0.75	-0.02	0.7940
MIX ( $\times 10^3$ )	2.49	2.25	0.24	0.3236
LYM (%)	41.64	41.68	-0.04	0.9854
MIXD (%)	13.71	15.11	-1.40	0.4214
NEUT (%)	44.43	42.37	2.06	0.4397
RDW-CV (%)	14.08	16.26	-2.18	0.3119
RDW-SD (%)	42.78	42.34	0.44	0.3973
PDW (%)	16.78	15.59	1.19	<u>0.0259</u>
MPV (fL)	11.23	12.71	-1.48	0.4458
P-LCR (fL)	28.30	26.81	1.49	0.1019
PCT (ng/ml)	0.29	0.29	0.01	0.7018



Table (8): The effect of smoking duration on the measures of complete blood count (n = 50 cases)

Complete blood count	Duration of smoking (years)			Overall mean	P value
	< 5	5–10	> 10		
WBC ( $\times 10^3$ )	4.11	5.22	6.58	5.38	<u>0.0419</u>
RBC ( $\times 10^3$ )	5.29	5.17	5.25	5.24	0.5110
HGB (g/dL)	14.10	14.13	13.45	14.06	0.4020
HCT (%)	43.46	42.83	41.73	43.08	0.1730
MCV (fL)	82.67	83.14	79.70	82.61	0.5610
MCH (pg)	26.96	27.43	25.73	27.04	0.7550
MCHC (g/L)	32.54	32.99	32.28	32.69	0.6360
PLT ( $\times 10^3$ )	266.74	262.37	251.50	263.86	0.6480
LYM ( $\times 10^3$ )	2.12	2.41	1.68	2.20	0.9810
MIX ( $\times 10^3$ )	0.67	0.84	0.57	0.73	0.5760
NEUT ( $\times 10^3$ )	2.59	1.96	4.33	2.49	0.4640
LYM (%)	40.08	46.57	28.78	41.64	0.8560
MIXD (%)	12.57	16.33	8.98	13.71	0.6810
NEUT (%)	46.61	37.37	63.25	44.43	0.7870
RDW-CV (%)	14.11	14.02	14.13	14.08	0.6190
RDW-SD (%)	43.06	42.69	41.28	42.78	0.1140
PDW (%)	16.84	16.56	17.38	16.78	0.9280
MPV (fL)	11.41	11.01	11.05	11.23	0.1730
P-LCR (fL)	29.04	27.38	27.65	28.30	0.0840
PCT (ng/ml)	0.30	0.29	0.27	0.29	0.2690

Table (9): The effect of smoking frequency on the measures of complete blood count (n = 50 cases)

Complete blood count	Frequency of smoking (daily)		Overall mean	P value
	< 10	≥ 10		
WBC ( $\times 10^3$ )	4.27	6.01	5.38	<u>0.0473</u>
RBC ( $\times 10^3$ )	5.27	5.13	5.24	0.3669
HGB (g/dL)	14.12	13.80	14.06	0.3188
HCT (%)	43.31	42.18	43.08	0.2127
MCV (fL)	82.65	82.45	82.61	0.9104
MCH (pg)	27.06	26.99	27.04	0.9342
MCHC (g/L)	32.69	32.73	32.69	0.9085
PLT ( $\times 10^3$ )	268.55	245.10	263.86	0.2790
LYM ( $\times 10^3$ )	2.23	2.07	2.20	0.4955
MIX ( $\times 10^3$ )	0.71	0.82	0.73	0.3690
NEUT( $\times 10^3$ )	2.54	2.28	2.49	0.5985
LYM (%)	42.10	39.82	41.64	0.5710
MIXD (%)	13.11	16.11	13.71	0.1775
NEUT (%)	44.52	44.08	44.43	0.9267
RDW-CV (%)	14.12	13.91	14.08	0.0932
RDW-SD (%)	42.98	41.99	42.78	0.1453
PDW (%)	16.74	16.94	16.78	0.7147
MPV (fL)	11.23	11.21	11.23	0.9414
P-LCR (fL)	28.34	28.13	28.30	0.8401
PCT (ng/ml)	0.30	0.27	0.29	0.1809

#### IV. DISCUSSION

The effect of Cannabis "marihuana" on hematological parameters has been discussed by many authors as it is the most popular illegal drug used worldwide. This study had demonstrated the effects of cannabis abusing and Cigarette smoking on some hematological parameters, including 100 Sudanese participants, divided into 50 Sudanese individuals smoking cannabis plants as the case group and 50 healthy Sudanese individuals as the control group. Our study revealed a significant higher increase in the WBCs, HCT, absolute neutrophil count and RDW-SD, with P.values equal= (0.012), (0.005), (0.04) and (0.0004) respectively. The WBCs count was higher in case group (mean=6.26) cell/ $\mu$ l compared with control group (mean=5.20) cell/ $\mu$ l. This result was agreed with Deryas study (8) and disagreed with Amaechi and his colleagues study (6). Also, HCT showed a statistically significant higher difference between the case group and the control groups, in which the mean in case group was (46.6) % and (43.2) % in control group. Our result disagreed with the study carried in Nigeria by Amaechi and his colleague which showed lower HCT (6). The mean of Neutrophils absolute count in the case group was (2.5) cell/ $\mu$ l compare with (1.88) cell/ $\mu$ l in the control group. Our result was agreed with stud carried by Derya (8) and disagreed with the studies carried by Amaechi (6) and Salma studies (7). While the brilliant highly significant difference in the mean of RDW-SD in case group, which equal (44.7) fl was higher compare with control group (42.4) fl. This result was agreed with findings of the Derya study that their study showed a significantly increase in RDW-SD (8). On the other hand, our study revealed a significant lower difference in platelete count and lymphocyte percentage count with Values equal (0.04) and (0.02), respectively. Which agreed with the studies carried out by Amaechi (6) and salma (7). While the insignificant differences of RBCs (P.Value=0.35) were agreed with Salma, Amna and, Bashiri studies (7, 9, 10). Also, Hb concentration revealed no significant difference between both groups with P. Value (0.42) which agreed with Amna, Bashiri and, Derya studies (10). All studies agreed with our findings revealed no significant difference on RBCs indices; MCV, MCH, MCHC, MPV, PDW and P-LCR. Differences in our findings from previous studies may be attributed to the racial, genetic, geographic, nutritional status, duration of cannabis abusing and differences in sample size included. (8, 9). Among Sudanese cigarette smokers, our result showed that measures of CBC were significantly higher among the cases group compared to the control group in mean cell volume ( $p = 0.0362$ ), and in PDW ( $p = 0.0259$ ) and the duration of smoking and its frequency significantly increase white blood cells count ( $p = 0.0419$ ), ( $p = 0.0473$ ) respectively. Our result revealed that there was a significant increase in MCV

and this finding disagree with Naser M Ergiah, et al, Rawia O. A Mustafa and Muhammad Asif, et al finding that showed there was no significant difference in MCV.(14) (15) (17) Similarly, we found that there was a significant increase in PDW in among smokers compared to non-smokers and these findings disagree with Muhammad Asif, et al. Findings which show that did not show any significant difference in PDW. (17) Furthermore, our result stated that there was no significant difference in MCH, RDW, PLT, MPV and this result agree with Muhammad Asif, et al findings which show that it did not show any significant difference in MCH, RDW, PLT, MPV.(17). On the other hand, our result showed no significant difference in WBCs, RBCs, Hb and ,MCHC and this disagree with Naser M Ergiah, et al findings that stated there was a significant increase in these parameters.(14) Also, our result reported that there was no statistically significant difference in total WBCs and, platelets count and this result disagrees with Dinesh et al which their results show there was a slight increase in white blood cells (WBCs) and platelets observed in smokers compared with non-smokers.(13). We found that there was no statistically significant difference in MCH and PLT and this findings agreed with Naser M Ergiah, et al result.(14) . Similarly, we found that there was no statistically significant difference in RBCs, HB, HCT, MCH, RDW-SD, RDW-CV, Neutrophils, Monocytes and, Eosinophils. And this result disagrees with Rawia O. A Mustafa finding that stated a significantly increase in these parameters and Muhammad I. Khan, et al result which reported that Hemoglobin, RBC Count, HCT and MCH were significantly increased.(15) (16). Furthermore, we found that there was no significant difference in PLT count and these finding disagrees with Rawia O. A Mustafa finding that showed there was a significant decrease observed in PLT count. (15). Finally, we found no significant difference in WBC, RBC, Hb, HCT, MCHC and PCT and, this result disagrees with Muhammad Asif, et al findings which show that WBC, RBC, Hb, and HCT were significant high, at the same time MCHC and PCT were significantly low. (17)

#### V. CONCLUSION

Our study concluded that some hematological parameters in cannabis smokers differ significantly from non-smoker ones. The most likely consequences are an increase in TWBCs count, HCT, Neutrophils absolute count and, RDW. Also, the study revealed that cannabis abusing results in a low level of platelet count and lymphocyte percentage count., there was no change in RBCs count, Hb concentration, MCV, MCH, MCHC, MPV, PDW and ,P-LCR. Among Sudanese cigarette smokers, the study concluded that smoking might result an increase of MCV and PDW and, long smoking duration and high frequency per day may lead to high

total white blood cells count. Our result concluded that there was no significant difference in other CBC parameters.

List of Abbreviation

RBCs	Red blood cells
Hb	Hemoglobin
PCV	Packed cell volume
MCV	Mean cell volume
MCH	Mean cell hemoglobin
MCHC	Mean cell hemoglobin concentration
RDW	Red cell distribution width
WBCs	White blood cells
plts	Platelets
PCT	Plateletcrit
MPV	Mean Platelet Volume
PDW	Platelet Distribution Width

### Declarations

*Ethical approval and consent to participant:* Approval of This study was obtained from the hematology department of medical laboratory science MLS, Alfajir College, and the ministry of health issued by the local ethical committee Khartoum State Sudan. Written consent was taken from each member of the study.

### Consent for publication

Not applicable.

### Availability of data and materials

The datasets generated during and / or analyzed in this study are not publicly available due to ethical policy in order to protect participant confidentiality.

### Competing interest

The authors declare that they have no competing interests.

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### Authors contributions

AA, AI, AS and, AH contributed in literature search and manuscript writing. AI and AS had the main idea of the study and contributed to manuscript writing, AA contributed to clinic work, AH contributed to statistical analysis. AA supervised the study and, critically reviewed the manuscript. All authors read and approved the final draft of the manuscript.

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# Factors Conditioning the Adherence to Pharmacological Prescription in Patients with Hypertension Attending Primary Healthcare Units in Quito - Ecuador

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& Victor Hugo Mena Maldonado

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**Abstract-** Low adherence to pharmacological treatment in patients diagnosed with hypertension is related to poor blood pressure control and an increased incidence of cardiovascular complications and deaths. A cross-sectional study was performed to determine conditioning factors towards adherence. Questionnaires and clinical evaluations were applied to 187 patients attending three first-level health units; in 130 of them laboratory tests were carried out. Diagnostic criteria were based on the European Clinical Practice Guidelines; adherence was based on the Morinsky test. 57.1% of patients had blood pressure values above the controlled threshold, and 71.1% reported non-adherence to pharmacological prescription. Factors associated with low adherence were coexisting moderate to severe depression (OR = 2,054; CI 1,064 - 3,964), low educational level ( $3.75 \pm 3.05$  years), poor understanding of medical prescriptions (OR = 2.3 CI 1.188 - 4.477), irregular supply and limited economic access to prescribed drugs ((OR = 1.97 CI 1.08 - 3.817), and low satisfaction with the care offered at health services (OR = 2.45; CI 1.202-5.00).

**Keywords:** medication adherence; hypertension; risk factors; primary health care.

**GJMR-I Classification:** NLMC Code: QV 4



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**Abstract-** Low adherence to pharmacological treatment in patients diagnosed with hypertension is related to poor blood pressure control and an increased incidence of cardiovascular complications and deaths. A cross-sectional study was performed to determine conditioning factors towards adherence. Questionnaires and clinical evaluations were applied to 187 patients attending three first-level health units; in 130 of them laboratory tests were carried out. Diagnostic criteria were based on the European Clinical Practice Guidelines; adherence was based on the Morinsky test. 57.1% of patients had blood pressure values above the controlled threshold, and 71.1% reported non-adherence to pharmacological prescription. Factors associated with low adherence were coexisting moderate to severe depression (OR = 2,054; CI 1,064 - 3,964), low educational level (3.75 ± 3.05 years), poor understanding of medical prescriptions (OR = 2.3 CI 1.188 - 4.477), irregular supply and limited economic access to prescribed drugs ((OR = 1.97 CI 1.08 - 3.817), and low satisfaction with the care offered at health services (OR = 2.45; CI 1.202-5.00).

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## 1. INTRODUCTION

Hypertension (HTN) constitutes a public health problem and represents the core risk factor for premature death worldwide (Chow & Gupta, 2019; GBD 2017 Risk Factor Collaborators, 2018). Its control depends directly on the quality and timeliness of the medical diagnosis, treatment, and follow-up of the individual patient and effective health systems (Marrugat et al., 2003). Given that cheap and effective anti-hypertensive treatments are available, hypertension control and prevention of the morbidity and mortality that

it generates should be achievable (Chow et al., 2013; McAlister et al., 2011). However, even in high-income countries, a significant proportion of people with hypertension do not know their diagnosis, and among those who do, a minority have been treated and have appropriate control (Maimaris et al., 2013; Pereira et al., 2009). Worldwide, it is estimated that only one in seven people have their pressure under control, that is, a blood pressure (BP) less than 140/90 mm Hg. Some of the obstacles that have been described to achieve BP control are the absence of comprehensive health services at the primary care level, limited access to drugs, and failure of health systems to effectively manage the prevention and treatment of the disease (MacMahon et al., 2008; Patel et al., 2016).

Available literature shows a clear correlation between a low level of adherence and less blood pressure control. Additionally, it has been associated with adverse outcomes such as cerebrovascular accidents, heart failure, myocardial infarction, and death. Impaired adherence constitutes a critical barrier for the reduction of blood pressure (Gosmanova & Kovesdy, 2015; Peacock & Krousel-Wood, 2017). However, the rates of adherence to medical prescriptions by patients with chronic conditions are very low. It is estimated that between 20-50% of patients suffering from these diseases do not take their medication as prescribed. An even larger number do not comply with the indications on changes in lifestyle (Kripalani et al., 2007). In the case of HTN, evidence shows that it affects 30 to 65% of patients and that 87.3% of uncontrolled patients presented failures in adherence to medical prescription (Abegaz et al., 2017). Because of its consequences on the health status, such as therapeutic failures, increased hospitalization rates, and increased healthcare costs, the WHO considers low adherence a priority public health issue (World Health Organization, 2004).

Lack of adherence is multidimensional. The factors that contribute to its existence are categorized into those related to the patient, such as socioeconomic status, inadequate knowledge of the disease, and costs of medication, and those related to the health system

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and equipment. Additionally, there are factors related to the treatment itself and those related to the disease (World Health Organization, 2004). It is necessary to study the adherence to prescription, as well as the main factors that condition compliance with medical indications, in particular those related to deficiencies in the quality of care provided by health services to hypertensive patients and their consequences on the morbidity and mortality caused by HTN.

The objective of this study was to determine the factors related to the patient, their clinical status, and the health services that facilitate or limit the adequate adherence to pharmacological treatment of patients who attend first-level health units in the South of Quito.

## II. METHODS AND PROCEDURES

### a) Study Design

This research is a cross-sectional study carried out between February and November 2012 by the Faculty of Medicine of the Pontifical Catholic University of Ecuador (PUCE) and the University of Michigan. The Research Bioethics Committee of the Pontifical Catholic University of Ecuador (PUCE) and the Central University of Ecuador (Universidad Central del Ecuador) approved the study protocol. The Ministry of Public Health of Ecuador also approved the project.

### b) Research scope and subjects

Study universe corresponded to all patients with diagnosed hypertension who regularly attended the health services belonging to the Ministry of Public Health of the District of Guamaní. This District is located in a suburban area south of the city of Quito; it serves 51,986 direct beneficiaries, 99,143 indirect beneficiaries with a total of 151,129 beneficiaries: Health care is covered by a type C Health Center and by type A and B health services. Three units were intentionally selected: the Guamaní Health Center, which, as the main center of the area, brings together the biggest number of patients with HTN. The *Social Assistance* Health Sub center that has the highest number of hypertensive patients registered in the health units attached to the area; and the *Pueblo Unido* health sub-center; where a family doctor works and provides care and follow-up to patients and their families with a comprehensive health approach.

Sampling was not carried out since all patients registered in these three units were included in the research, given they could be located and voluntarily agreed to participate in the study. The total number of patients with HTN registered in the units was 298, of which 188 (63.1%) participated in the study; one survey was eliminated due to incomplete information, thus  $n = 187$ .

### c) Data collection

A questionnaire that included sociodemographic information and information on the diagnosis, control, and follow-up by the health services of each patient was applied. A clinical evaluation including taking, recording, and classification of blood pressure values was carried out following the recommendations of the JNC-7 (DEPARTMENT OF HEALTH AND HUMAN, 2003); as well as anthropometric measurements (weight, height, abdominal circumference), assessment of cardiovascular risk and cognitive ability through the application of the Minimental test. Medical students from PUCE and the University of Michigan who received training and supervision from a faculty professor performed these procedures.

A subsample of the 130 patients who accepted the procedure had their blood glucose, cholesterol and creatinine determined. The samples were collected and analyzed by technicians from the PUCE clinical laboratory (DISERLAB) following international recommendations on biosafety and blood transport.

The criteria for evaluating the clinical status of the patient were established based on the European HTN Clinical Practice Guide (CPG) (ESH / ESC, 2013), which considers controlled hypertension when blood pressure values are  $\leq 140/90$  mg / mm and overweight or obesity when  $BMI \geq 25$ . Fasting blood glucose  $< 101$  mg/dl was classified as normal, 102 - 125 mg/dl as altered and  $\geq 126$  mg/dl as diabetes; creatinine values to normal, altered renal function were  $\geq 1.3$  mg/dl in men and 1.2 mg/dl in women; and the total cholesterol level was considered elevated when the values were  $\geq 190$  mg/dl.

Treatment adherence defined as compliance with the pharmacological indications, both in dose and schedule and complete consumption of the medication, was self-reported, based on the Morinsky test (Morinsky et al., 1986), considering as "adherent" those patients who fully complied with all the indications in the two evaluated dimensions.

### d) Information Analysis

For the statistical analysis, a database was generated in Excel, and quality control of the information was carried out. It was then imported into the SPSS v 18.0 program. The statistical analysis initially included descriptive statistics: the mean, median, mode, and standard deviation values of the quantitative variables such as Glucose, Creatinine, Cholesterol, BMI, and Creatinine Clearance values were determined. Percentages were calculated for the qualitative variables. Subsequently, a bivariate analysis was performed, using the OR as association measures and the Chi-square as a significance test for qualitative variables. For quantitative variables, the Kolmogorov normality test was applied to establish the test to be used for the difference in means, be it the Student's t or

the Mann-Whitney U; finally, a multiple regression model was performed.

### III. RESULTS

The demographic and clinical characteristics of the study population are described in Table 1. The mean age was 63.8 years (SD 12.7) with a range of 35 to 89 years; the proportion of women was higher (83.4%) than that of men. Patients reported a low level of education with an average of 4.27 (SD 3.38) years completed. Regarding the clinical status of the patients who underwent laboratory tests ( $n = 130$ ), it should be noted that more than 60% had hypercholesterolemia, 8.5% diabetes, 2.3% altered kidney function; and 86.5% were overweight or obese. 57.1% of patients had an uncontrolled blood pressure value.

#### a) Medication Adherence and its conditioning factors

28.9% (95% CI: 22.4% -35.4%) of the patients reported good adherence to the drug prescription, while 71.1% (95% CI: 64.6% -77, 6%) were non-adherent.

Table 2 shows the sociodemographic characteristics of the patients and their relationship with low adherence. Age (OR = 0.98); sex (OR = 0.69), living alone (OR = 0.79), having a partner (OR = 1.36) or working (OR = 1.28), were not statistically significantly associated with adherence to pharmacological treatment. In contrast, the average number of years of formal education completed was significantly lower in non-adherent patients ( $3.75 \pm 3.05$  years) than in adherent patients ( $5.65 \pm 3.7$  years). Factors related to self-care, such as referring to carrying out actions and the need for another person's assistance for this purpose, were not significantly associated with adherence. However, the proportion of non-adherence was higher in patients who reported performing these actions (69.2%) or perceiving the need to do so 74.8%, with ORs of 1.25 and 1.48, respectively.

Table 3 presents the factors related to the patient's clinical status, showing that there are no significant differences between adherents and non-adherents in terms of the presence or absence of hypercholesterolemia, diabetes, being overweight or obese, or with the cognitive status of the patient. However, people who presented moderate or severe depression showed a higher risk of non-adherence than those without this health problem (OR = 2,054; CI 1,064 - 3,964).

#### b) Conditioning Factors for Adherence Related to Health Services

Table 4 presents the conditioning factors for adherence related to the organization and operation of health services.

The need for help in reading medical indications was greater among the non-adherent, but the difference with the adherent subjects was not statistically

significant. That doctors inquire about adherence and that the patient understands the prescribed medications, disrespect for patients' opinions by health professionals, and not shared goal setting with patients, were also not associated in a statistically significant degree with adherence. Regarding the indications written by the doctor or nurse, it was found that patients who reported having little or no understanding of these had a higher risk of non-adherence (OR = 2.3 CI 1.188 - 4.477) than those who did understand them. The irregular and incomplete supply of drugs by health units also constituted a risk factor for low adherence (OR = 1.93 CI 1.022-3.74). Difficulty in accessing prescribed drugs due to lack of economic means increased the risk of not complying with treatment (OR = 5.715; CI 2.85-11.43). The perception of patients about disrespect for their beliefs (OR = 1.97 CI 1.08 - 3.817) and the little or no satisfaction of patients with health services (OR = 2.45; CI 1.202-5.005) were also related to low adherence to pharmacological indications.

The logistic regression model (Table 5) shows that factors that constitute facilitators of adequate adherence were higher education level, having economic means to access the prescribed medications, respect for patient's beliefs, and patient satisfaction with health services.

Even though non-adherents had a higher proportion of inadequate blood pressure control, the difference with adherents was not statistically significant ( $p = 0.081$ ); see table 6.

### IV. DISCUSSION

The present study contributes to the understanding of the obstacles to adherence to their pharmacological indications in patients with HTN seen at the first level of care. Collected data showed that seven out of ten hypertensive patients were non-adherent to the prescribed drug treatment, and more than half of the patients had inadequate blood pressure control. In addition, about three-quarters of the patients were obese or overweight, 60% had hypercholesterolemia, and 21% had moderate to severe cognitive impairment. However, no association was found between low adherence and inadequate control of hypertension or an impaired clinical status, except that patients with moderate or severe depression were less compliant. Regarding patient-related factors linked to poor adherence, the low level of education (average years of formal education completed) stands out. Regarding health services, it was found that poor understanding of medical indications, irregular supply of medicines, reduced access to affordable drugs, and low level of satisfaction with health services increased the possibility of poor adherence.

Reduced adherence to medical indications in general, and pharmacological prescription in particular,

is a highly prevalent problem in the care of patients with chronic diseases and represents a priority for public health (Patel et al., 2016; Peacock & Krousel-Wood, 2017). In patients with hypertension poor adherence has been associated with lesser blood pressure control, cardiovascular complications, and death (Burnier & Egan, 2019; Gosmanova & Kovesdy, 2015). In the United States, an estimated 125,000 annual deaths and 33% to 69% of hospital admissions are due to poor adherence (Bosworth et al., 2011). Regarding health systems treatment failure increases hospitalization rates and health costs (World Health Organization, 2004). Therefore, timely detection and correction of low adherence should be part of the care and follow-up of patients with chronic diseases.

This study did not show a statistically significant association between non-adherence and poor blood pressure control. However, the proportion of non-adherence was higher in uncontrolled patients (61%). Other studies have shown that non-adherence is the key factor for uncontrolled blood pressure (Burnier & Egan, 2019; van der Laan et al., 2017); non-adherence increases significantly in uncontrolled patients (from 45.2% to 87.3%) (Abegaz et al., 2017). Lor Maichou et al. (Lor et al., 2019) asserts that adherence above 80% to antihypertensive medication is essential for optimal blood pressure control.

WHO estimates that the prevalence of non-adherence to antihypertensive drug treatment worldwide ranges from 30 to 50% (World Health Organization, 2004). In the study by Zullig (Zullig et al., 2015), non-adherence was 58.1%, and in that of Lor (Lor et al., 2019), non-adherence was 88.4%. A systematic review of 28 studies carried out in 15 countries shows a prevalence of non-adherence of 45.2% (Abegaz et al., 2017), and the research by Steiner (2009) found a mean therapeutic adherence of 70%, where only 36% obtained more than 80% of the prescription drugs. Adherence rates in patients with hypertension are very diverse, and the magnitudes reported in the different studies cannot be compared due to the use of various indicators and measurement instruments. However, the default value found in this study (71.1%) may indicate of the gap that exists between high and low and middle-income countries.

Lack of adherence is a complex, multifactorial problem; its conditioning factors can be classified according to their relations with the pathology, the patient, the health system, the doctor-patient relationship, or with the treatment itself (Khatib et al., 2014; van der Laan et al., 2017). In this study, there was no association between demographic factors such as sex, ethnicity, or age of the patient. While some research has found that men are less adherent than women, that evidence is conflicting. The study "Cohort Study of Medication Adherence among Older Adults (CoSMO)" (M. Krousel-Wood et al., 2011) reported very low

adherence to medication (14%) in patients older than 65 years of age; these values vary according to age group, sex, and ethnicity (MA Krousel-Wood et al., 2009). In the present study, patients with lower education had lower adherence, which corroborates what was reported by other studies in which a low level of education and reduced knowledge about the disease and treatment were significantly associated with low adherence (Parra et al., 2019).

International evidence suggests that clinical conditions, and in particularly cognitive dysfunction and mental health problems, constitute relevance obstacles for adherence (Steiner et al., 2009; Zullig et al., 2015). In this study, no significant association was found between hypercholesterolemia, excess weight or obesity, and low adherence. However, the coexistence of hypercholesterolemia and hypertension is common: Tadick & Cuspidi found that 69.7% of hypertensive patients presented hypercholesterolemia.

This study shows that the presence of moderate/severe depression constitutes a risk factor for non-adherence; these results are similar to those reported by (M. Krousel-Wood et al., 2011; Lor et al., 2019), who found that depressed people with chronic diseases are more likely to not comply with the prescribed treatment. Therefore, doctors should carry out a timely detection and adequate treatment of depression, especially in patients with poor adherence and poor blood pressure control.

Ecuador has made great efforts to implement comprehensive reforms and a public policy aimed to regulate health care (Espinosa, 2017), this does not guarantee compliance at the local level. Free access to care in public health services and the formulation of plans and programs aimed at providing permanent and timely access to comprehensive health care, based on the principles established in the Constitution (Constitution of the Republic of Ecuador, 2008), have not always crystallized in benefits provided to patients with chronic diseases who are cared for at the first level. Different authors report an association between low adherence with the following factors of the health care system: not being able to read the written instructions regarding the management of the disease, not receiving information about hypertension, no availability of out-of-pocket expenses to access care and medications, deficiencies in the relationship and communication between patient and their healthcare provider, in addition to a general patient's perception of receiving poor quality of care (Parra et al., 2019; van der Laan et al., 2017).

To reduce the risk and burden of morbidity and mortality from cardiovascular diseases in low or medium per capita income countries WHO proposes different strategies to improve control, monitoring, and follow-up of hypertensive patients. The main recommendation is to strengthen actions to improve the levels of



knowledge, treatment, and control of hypertension, emphasizing the timely detection, selection, and appropriate use of medications and therapeutic adherence (World Health Organization, 2013). The challenge for many health systems is to seek strategies that reduce detected deficiencies, such as failures in the follow-up and the coordination in care, and patients receiving insufficient information that leads them to have difficulties in self-managing their disease (Samb et al., 2010). It is essential to improve patient follow-up and provide quality care in medical consultation, as it constitutes an opportunity to make clinical decisions based on blood pressure values and at the same time, provide counseling and evaluate adherence to treatment (Zuo et al., 2019).

In the clinical management of hypertension, patients are in charge of 95% of their daily care. Although this self-care goes beyond taking the prescribed medication, this aspect being the least complicated, it is vital to guarantee control of blood pressure levels (Comarca, 2011). Ultimately, adherence to the pharmacological prescription corresponds to patients' decision and autonomy; however, health services have a relevant role to play to help them have better compliance to medical prescription. Establishing effective channels of communication between health providers and their patients, which can help to understand the disease and the treatment by the latter, as well as share decision-making regarding the clinical management, are key conditioning factors to achieve this goal (Martínez C. et al., 2016; World Health Organization, 2013).

This study has the following limitations: it was carried out in a specific area of the Metropolitan District of Quito and one Type- C and two Type-A healthcare units belonging to the Ministry of Health; therefore, it cannot be generalized to all health services in Quito. Self-reporting was used in several of the indicators, especially in adherence. Additional questions were included in the Morinsky test to have more information on adherence, but this limits its international comparability. People who refused to take one of the tests represented up to 6% of the non-adherent subsample.

## V. CONCLUSIONS

The efficacy of antihypertensive medications in controlling blood pressure and reducing adverse outcomes in morbidity and mortality from cardiovascular diseases is well documented. However, patient's adherence to the pharmacological treatment prescribed by the health professional plays a central role in achieving the objectives for adequate clinical management of this disease. The factors that determine the low adherence are multidimensional; in the present study, the logistic regression model showed that higher

educational level and having the economic means to access drugs represent factors that facilitate compliance with the pharmacological prescription. Regarding the healthcare services and team, the main conditioning factors for adherence are respect for the beliefs of patients and patient satisfaction with health services. Comprehensive strategies should be implemented for the management of hypertension, improving patient follow-up, not only about blood pressure control but also through the implementation of locally adapted strategies aimed at improving the clinical condition of patients and their quality of life.

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*Table 1:* General Characteristics of the Study Population

Sociodemographic	Frequency or Mean	Percentage or SD
<b>Age</b>	63.8 ( $\bar{x}$ )	12.7 (SD)
Level of education		
Years approved	4,27 ( $\bar{x}$ )	3,38 (SD)
<b>Sex</b>		
Female	156	83.4
Male	31	16.6
<b>Marital Status</b>		
No partner	79	42.0
With partner	108	57.8
<b>Employment</b>		
Yes	51	27.4
No	135	72.6
<b>Clinical Status</b>		
<b>Cholesterol</b>		
Normal	46	35,4
Elevated	84	64,6
<b>Blood Glucose</b>		
Normal	109	83,8
Altered	10	7,7
Diabetes	11	8,5
<b>Creatinine (renal dysfunction)</b>		
Yes	3	2,3
No	127	97,7
<b>BMI</b>		
Normal	25	13,5
Overweight/Obesity	160	86,5
<b>Cognitive impairment</b>		
Mild	143	79
Moderate	38	21
<b>Depression</b>		
Minimal/mild	61	67,2
Moderate/severe	125	32,8
<b>Hypertension</b>		
Uncontrolled	78	42,9
Controlled	104	57,1



Table 2: Patient's Factors Associated with Medication Adherence

Demographic characteristics	Non adherents (n=133)		Adherents (n=54)		OR	CI 95%	p-Value
	Frequency	Percentage	Frequency	Percentage			
<b>Age</b>							
≤ 65 years	69	71,9	27	28,1	0,98	0,43 – 1,74	0,816
> 65 years	64	70,3	27	29,7			
<b>Sex</b>					0,692	0,306 - 1,56	0,374
Male	20	64,5	11	35,5			
Female	113	72,4	43	27,6			
<b>Living with</b>							
Alone	10	66,7	5	33,3	0,797	0,259 - 2,45	0,768*
Family	123	71,5	49	28,5			
<b>Marital status</b>							
No partner	59	74,7	20	25,3	1,355	0,708 - 2,59	0,358
With partner	74	68,5	34	31,5			
<b>Employment</b>							
Yes	38	74,5	13	25,5	1,275	0,615 - 2,64	0,513
No	94	69,6	41	30,4			
<b>Education (years approved)</b>							
Mean	3,75		5,65				0,001**
SD	3,05		3,7				
<b>Impaired family economy</b>							
Yes	93	76,2	29	23,8	1,924	0,99 - 3,70	0,049
No	40	62,5%	24	37,5%			
<b>Selfcare</b>							
<b>Routine care</b>							
Few or nothing	56	73,7	20	26,3	1,249	0,64 - 2,40	0,50
Often/always	74	69,2	33	30,8			
<b>Support care</b>							
Yes	80	74,8	27	25,2	1,481	0,780 - 2,815	0,22
No	52	66,7	26	33,3			

Note: Some questions were not answered, they were considered as missing data. Thus, frequencies not always total the number of subjects included in the sample

Table 3: Factors Related to Patient's Clinical Status Associated With Adherence to Medication

Clinical features	Non-adherents		Adherents		OR	CI95%	p-value
	Frequency	Percentage	Frequency	Percentage			
<b>Cholesterol</b>							
Elevated	56	66,7	28	33,3	0,875	0,403 - 1,899	0,735
Normal	32	69,6	14	30,4			
<b>Blood glucose</b>							
Normal	70	64,2	39	35,8			0,144
Altered	9	90,0	1	10,0			
Diabetes	9	81,8	2	18,2			
<b>BMI</b>							
Normal	17	68	8	32	0,832	0,335 - 2,062	0,690
Overweight/Obesity	115	71,9	45	28,1			
<b>Cognitive impairment</b>							
Mild	99	69,2	44	30,8	0,698	0,305 - 1,598	0,431
Moderate	29	76,3	9	23,7			
<b>Depression</b>							
Moderate/severe	95	76,0	30	24,0	2,054	1,064 - 3,964	0,030
Mild	37	60,7	24	39,3			

Note: Some questions were not answered, they were considered as missing data. Thus, frequencies not always total the number of subjects included in the sample.

Table 4: Factors Related to Health Services Associated With Medication Adherence

Medical care	Non-adherents (n=133)		Adherents (n=54)		OR	CI95%	p-value
	Frequency	Percentage	Frequency	Percentage			
<b>Understanding written prescription</b>							
Few or nothing	98	76,6	30	23,4	2,306	1,188 - 4,477	0,013
Very good /excellent	34	58,6	24	41,4			
<b>Help to read instructions</b>							
Never/mild	74	67,3	36	32,7	0,638	0,329 - 1,237	0,182
Always/often	58	76,3	18	23,7			
<b>Health services providing prescribed pharmaceuticals</b>		7					
Occasionally/never	84	5,7	27	24,3	1,93	1,022 – 3,74	0,041
Always	43	61,4	27	38,6			
<b>Money availability to compliance with medication</b>							
No	106	82	23	17,8	5,715	2,857 - 11,43	0,000
Yes	25	44,6	31	55,4			
<b>Physician Inquiries Adherence</b>							
Yes	123	70,3	52	29,7	0,788	0,154 - 4,036	0,775
No	6	75,0	2	25,0			
<b>Understands about medicines</b>							
Few/nothing	92	73,6	33	26,4	1,428	0,738 – 2,76	0,289
Excellent	41		31				
<b>Respect to patient's opinion</b>							
Never/eventually	67	78,1	21	21,9	1,67	0,876 - 3,18	0,118
Always	63	65,8	33	34,2			
<b>Respect for patient's beliefs</b>							
Never/eventually	69	76,1	20	23,9	1,97	1,08 – 3,817	0,042
Always	56	65,6	32	34,4			
<b>Shared goal setting</b>							
Never/eventually	65	75,6	21	24,4	1,621	0,848 -3,098	0,142
Always	63	65,6	33	34,4			
<b>Satisfaction with Healthcare</b>		8					
Sometimes/never	59	1,9	13	18,1	2,453	1,202 - 5,005	0,012
Always	74	64,9	40	35,1			

Note: Some questions were not answered, they were considered as missing data. Thus, frequencies not always total the number of subjects included in the sample.

Table 5: Logistic Regression Model of Enabling Factors for Medication Adherence

Facilitators factors	OR AJUSTED	Confidences Intervals		p-value
Level of Education	1,1	1,034	1,294	0,011
Access to medicines	4,725	2,121	10,527	0,000
Respect for patient's beliefs	2,326	1,022	5,294	0,044
Satisfaction with health services	2,342	0,956	5,738	0,063



Table 6: Association of Adherence to Prescribed Medication And Hypertension Control

Adherence	Control (n=78)		Uncontrolled (n=104)		OR	Ic95%	p-value
	Frequency	Percentage	Frequency	Percentage			
Non-adherents	50	38,8	79	61,2	0,565	0,296 - 1,077	0,081
Adherents	28	52,8	25	57,2			

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<b>Certificate</b> , LoR and Momento 2 discounted publishing/year <b>Gradation</b> of Research 10 research contacts/day 1 GB Cloud Storage GJ Community Access	<b>Certificate</b> , LoR and Momento <b>Unlimited</b> discounted publishing/year <b>Gradation</b> of Research <b>Unlimited</b> research contacts/day 5 GB Cloud Storage <b>Online Presense</b> Assistance GJ Community Access	<b>Certificates</b> , LoRs and Momentos <b>Unlimited</b> free publishing/year <b>Gradation</b> of Research <b>Unlimited</b> research contacts/day <b>Unlimited</b> Cloud Storage <b>Online Presense</b> Assistance GJ Community Access	GJ Community Access



# PREFERRED AUTHOR GUIDELINES

## **We accept the manuscript submissions in any standard (generic) format.**

We typeset manuscripts using advanced typesetting tools like Adobe In Design, CorelDraw, TeXnicCenter, and TeXStudio. We usually recommend authors submit their research using any standard format they are comfortable with, and let Global Journals do the rest.

Alternatively, you can download our basic template from <https://globaljournals.org/Template>

Authors should submit their complete paper/article, including text illustrations, graphics, conclusions, artwork, and tables. Authors who are not able to submit manuscript using the form above can email the manuscript department at [submit@globaljournals.org](mailto:submit@globaljournals.org) or get in touch with [chiefeditor@globaljournals.org](mailto:chiefeditor@globaljournals.org) if they wish to send the abstract before submission.

## BEFORE AND DURING SUBMISSION

Authors must ensure the information provided during the submission of a paper is authentic. Please go through the following checklist before submitting:

1. Authors must go through the complete author guideline and understand and *agree to Global Journals' ethics and code of conduct*, along with author responsibilities.
2. Authors must accept the privacy policy, terms, and conditions of Global Journals.
3. Ensure corresponding author's email address and postal address are accurate and reachable.
4. Manuscript to be submitted must include keywords, an abstract, a paper title, co-author(s') names and details (email address, name, phone number, and institution), figures and illustrations in vector format including appropriate captions, tables, including titles and footnotes, a conclusion, results, acknowledgments and references.
5. Authors should submit paper in a ZIP archive if any supplementary files are required along with the paper.
6. Proper permissions must be acquired for the use of any copyrighted material.
7. Manuscript submitted *must not have been submitted or published elsewhere* and all authors must be aware of the submission.

## **Declaration of Conflicts of Interest**

It is required for authors to declare all financial, institutional, and personal relationships with other individuals and organizations that could influence (bias) their research.

## POLICY ON PLAGIARISM

Plagiarism is not acceptable in Global Journals submissions at all.

Plagiarized content will not be considered for publication. We reserve the right to inform authors' institutions about plagiarism detected either before or after publication. If plagiarism is identified, we will follow COPE guidelines:

Authors are solely responsible for all the plagiarism that is found. The author must not fabricate, falsify or plagiarize existing research data. The following, if copied, will be considered plagiarism:

- Words (language)
- Ideas
- Findings
- Writings
- Diagrams
- Graphs
- Illustrations
- Lectures



- Printed material
- Graphic representations
- Computer programs
- Electronic material
- Any other original work

## AUTHORSHIP POLICIES

Global Journals follows the definition of authorship set up by the Open Association of Research Society, USA. According to its guidelines, authorship criteria must be based on:

1. Substantial contributions to the conception and acquisition of data, analysis, and interpretation of findings.
2. Drafting the paper and revising it critically regarding important academic content.
3. Final approval of the version of the paper to be published.

### Changes in Authorship

The corresponding author should mention the name and complete details of all co-authors during submission and in manuscript. We support addition, rearrangement, manipulation, and deletions in authors list till the early view publication of the journal. We expect that corresponding author will notify all co-authors of submission. We follow COPE guidelines for changes in authorship.

### Copyright

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### Appealing Decisions

Unless specified in the notification, the Editorial Board's decision on publication of the paper is final and cannot be appealed before making the major change in the manuscript.

### Acknowledgments

Contributors to the research other than authors credited should be mentioned in Acknowledgments. The source of funding for the research can be included. Suppliers of resources may be mentioned along with their addresses.

### Declaration of funding sources

Global Journals is in partnership with various universities, laboratories, and other institutions worldwide in the research domain. Authors are requested to disclose their source of funding during every stage of their research, such as making analysis, performing laboratory operations, computing data, and using institutional resources, from writing an article to its submission. This will also help authors to get reimbursements by requesting an open access publication letter from Global Journals and submitting to the respective funding source.

## PREPARING YOUR MANUSCRIPT

Authors can submit papers and articles in an acceptable file format: MS Word (doc, docx), LaTeX (.tex, .zip or .rar including all of your files), Adobe PDF (.pdf), rich text format (.rtf), simple text document (.txt), Open Document Text (.odt), and Apple Pages (.pages). Our professional layout editors will format the entire paper according to our official guidelines. This is one of the highlights of publishing with Global Journals—authors should not be concerned about the formatting of their paper. Global Journals accepts articles and manuscripts in every major language, be it Spanish, Chinese, Japanese, Portuguese, Russian, French, German, Dutch, Italian, Greek, or any other national language, but the title, subtitle, and abstract should be in English. This will facilitate indexing and the pre-peer review process.

The following is the official style and template developed for publication of a research paper. Authors are not required to follow this style during the submission of the paper. It is just for reference purposes.



### ***Manuscript Style Instruction (Optional)***

- Microsoft Word Document Setting Instructions.
- Font type of all text should be Swis721 Lt BT.
- Page size: 8.27" x 11", left margin: 0.65, right margin: 0.65, bottom margin: 0.75.
- Paper title should be in one column of font size 24.
- Author name in font size of 11 in one column.
- Abstract: font size 9 with the word "Abstract" in bold italics.
- Main text: font size 10 with two justified columns.
- Two columns with equal column width of 3.38 and spacing of 0.2.
- First character must be three lines drop-capped.
- The paragraph before spacing of 1 pt and after of 0 pt.
- Line spacing of 1 pt.
- Large images must be in one column.
- The names of first main headings (Heading 1) must be in Roman font, capital letters, and font size of 10.
- The names of second main headings (Heading 2) must not include numbers and must be in italics with a font size of 10.

### ***Structure and Format of Manuscript***

The recommended size of an original research paper is under 15,000 words and review papers under 7,000 words. Research articles should be less than 10,000 words. Research papers are usually longer than review papers. Review papers are reports of significant research (typically less than 7,000 words, including tables, figures, and references)

A research paper must include:

- a) A title which should be relevant to the theme of the paper.
- b) A summary, known as an abstract (less than 150 words), containing the major results and conclusions.
- c) Up to 10 keywords that precisely identify the paper's subject, purpose, and focus.
- d) An introduction, giving fundamental background objectives.
- e) Resources and techniques with sufficient complete experimental details (wherever possible by reference) to permit repetition, sources of information must be given, and numerical methods must be specified by reference.
- f) Results which should be presented concisely by well-designed tables and figures.
- g) Suitable statistical data should also be given.
- h) All data must have been gathered with attention to numerical detail in the planning stage.

Design has been recognized to be essential to experiments for a considerable time, and the editor has decided that any paper that appears not to have adequate numerical treatments of the data will be returned unrefereed.

- i) Discussion should cover implications and consequences and not just recapitulate the results; conclusions should also be summarized.
- j) There should be brief acknowledgments.
- 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 through 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?
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<i>References</i>	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring



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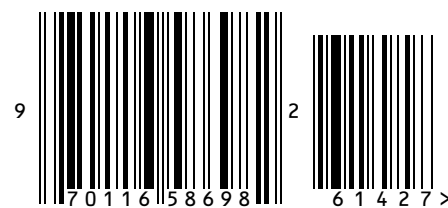
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