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MEDIAN NERVE COMPRESSION AFTER COLLES FRACTURE REDUCTION

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ABSTRACT

Colles' fracture is one of the most common fractures in all ages including old age group. Carpal tunnel syndrome is a common complication of this fracture, it is very important to select the type of analgesia or anesthesia to avoid the occurrence of carpal tunnel syndrome. **Objective:** The aim of the study is to assess the risk of carpal tunnel syndrome occurrence after hematoma block in reduction of Colles' fracture in comparison with reduction under other methods of analgesia (Conscious analgesia, general anesthesia, Bier′s block). **Patient and Methods:** A comparative prospective study of 80 patients diagnosed with Colles′ fracture in the emergency department of Al-Jumhoori and Al-Salam Teaching Hospitals in Mosul from January 2020 – to December 2020. Patients are randomized into 2 groups, 40 patients for each group, in the 1st group the fracture was reduced under hematoma block anesthesia, while in the 2nd group the reduction done under sedative analgesia, Bier′s block or general anesthesia. All patients were examined for symptoms and signs of median nerve compression carpal tunnel syndrome (CTS) pre reduction, immediately after reduction, after 2 days, 1 week and every 2 week for 6 week. All patients were reduced and immobilized in the same way. **Results:** The 80 patients who included in the study were free from signs and symptoms of CTS. The incidence of CTS was (27.5%) in group 1 with hematoma block and (8.3%) in group II with different methods of analgesia. **Conclusion:** According to the results of this study we suggested the use of hematoma block as a method of anesthesia in reduction of Colles′ fracture just for those patients who were not fit for other methods of analgesia.

KEYWORDS: Colles′ fracture, Fracture Reduction, Hematoma Block, Median Nerve Compression.

1. INTRODUCTION

Colles′ fracture is the injury that Abraham Colles′ described in 1814 as a transverse fracture of the radius just above the wrist, with dorsal displacement of the distal fragment. It is the most common of all fractures in older people.[1] The mechanism of injury of Colles′ fracture is a fall on an outstretched hand causing tension forces on volar aspect of the radius with bending and compression forces on dorsal aspect of the radius, with shear and/or compression component. We can recognize it clinically by dinner-fork deformity.[2] This fracture can be presented with many complications which can be classified as early complications, difficult reduction, loss of reduction, unstable reduction, median nerve compression which is one of most common complication (13%) of cases, associated carpal bones injury, pain dysfunction syndrome, in addition to Intermediate and late like loss of reduction and deformity (malunion). delayed union and non-union, stiffness of shoulder, elbow and fingers, median nerve compression (carpal tunnel syndrome) and extensor policies longus tendon rupture.[3,4]

Carpal Tunnel Syndrome is compression of median nerve within the confines of the carpal tunnel which is characterized by pain and paresthesia, in the distribution of median nerve in the hand. Normal pressure in the carpal tunnel approximately 2.5 mmHg when pressure exceed 20mmHg. The epineural blood flow decrease and nerve become edematous, and when it exceeds 30mmHg the nerve conduction decrease.[5] CTS is one of the most common complication of fracture of distal radius.[6] The incidence of median nerve compression in Colles′ fracture range between (0.7 – 17 %) of cases. Any condition that crowds or reduce the capacity of carpal tunnel may initiate the symptoms; Colles′ fractures and edema from trauma are among the most obvious causes. In the treatment of Colles′ fracture, immobilization in marked

flexion and ulnar deviation can cause acute compression.[7,8,9] Nerve conduction study (NCS) is more valuable than electromyography (EMG) study in general because of the underlying pathophysiology of focal demyelination in CTS.[10,11] Hematoma block is used for reduction of fracture since it is quick and easy. However, it does not provide anesthesia as good as some of other technique. There is also the potential for infection.[12,13] The skin over the fracture site is sterilely prepared and a small needle is placed into hematoma. After blood is aspirated to help decrease swelling 5 to 10 ml of anesthesia (1% plain lidocaine) in injected into the hematoma and surrounding periosteum through single port. Generally, anesthesia occurs within 5-10 min and as with other blocks may last as long as several hours. Hematoma block is one of the most common method used for Colles' fracture reduction.[14] A mean peak level of 2625 microgram/ L of blood was found when 10 ml of 2% lidocaine was used and mean peak level of 846 microgram/ L in patient receiving 10 ml of 1 % Lidocaine which is not toxic and is the recommended dose for local infiltration.[15,16]

2. PATIENTS AND METHODS

A comparative prospective study of 80 patients diagnosed with Colles′ fracture in the emergency department of Al-Jumhoori and Al-Salam Teaching Hospital in the Mosul from January 2020– to December 2020. Age of those patients was ranged from 18 – 74 years, mean age was 46 years, 48 patients were females and 32 of them were males. The patients divided in to 2 groups randomly: First group: 40 patients were given hematoma block Fig. (1) then reduction of the fracture done as follow: Each of those patients receive 10 ml of 1 % lignocaine which was infiltrated dorsally in to the fracture hematoma after aspiration of blood, waiting for 10–15 min. then the Colles′ fracture was reduced by traditional method of closed reduction followed by application of dorsal back slab just below Elbow. Second group: 40 patients randomly recruited into three subgroups. In which Colles′ fracture was reduced as: 24 patients were reduced via analgesia (Tramadol 100 mg) and sedation with diazepam, 5-10 mg slowly intravenously. two patients were reduced via Bier′s block. Fourteen patients were reduced via GA. due to other associated injury. The fractures in all patients were reduced by the same method and back slab was applied in 20 degree of flexion and 15 degree of ulnar deviation of the wrist joint. Fig. (2)

Fig. (1): Reduction of Colle's fracture under hematoma block.

Fig. (2): Colle's fracture Reduction.

Patients who were excluded from the study are those with previous carpal tunnel release to exclude the effect of fibrosis and released transverse carpal ligament. Pregnant woman to exclude the effect of fluid retention. Incomplete follow up. Those patients with Colles′ fracture that required other methods of treatment (ligamentotaxis, percutaneous pin- etc.). All patients in both groups were examined before reduction for any signs of median nerve compression. (Immediately following reduction and applicant of back slab. after 2 days. after 1, every 2 weeks for 6 weeks. EMG, NCS was done at 6 weeks).The examination included looking for symptoms and signs of median nerve entrapment which are anesthesia and later on nocturnal paresthesia. pain in the hand, weakness in the hand, sensory symptom in area of median nerve distribution. clinical test Tinels sign (percussion test), Phalen test, Compression test (Durkan test). Carpal tunnel can be confirmed by Nerve conduction study and Electromyography. Any patient, who has any symptoms or sign with positive neurophysiological test, is regarded as having median nerve compression. All patients presented with Colles′ fracture. Treated by closed

reduction and dorsal back slab replaced by pop after 1 week and kept for 6 weeks from time of the fracture. All patients were given the same type of analgesia. Other associated injuries were dealt with them accordingly. (If the patient has neck pain, x-ray of cervical spine was done to exclude cervical spondylosis and double crush phenomenon). All fractures were immobilized in 20° flexion and 15°-degree ulnar deviation at wrist.

3. RESULTS

Eighty patients with Colles' fracture were studied. 40 were reduced under local infiltration (Hematoma block) and the other 40 patients their fractures were reduced by other methods (24 Analgesia, 2 Bier's Block, and 14 G.A). Ten of the females were diabetic and 4 were hypertensive, 6 of the males were diabetic and 3 hypertensives. Group one 40 patients who their fractures were reduced under hematoma block. 11 patients out of those 40 developed CTS. (27.5%). (Tab.1), 5 patients out of those 11 patients were diabetic and 3 was hypertensive. 9 patients out of those 11 patients were females 2 were males. Group two 40 patients who their fractures were reduced under other methods 2 patients out of 24 patients who were reduced under conscious analgesia developed CTS. (8.3%) (Tab1). Both of them were females. 1 patient was diabetic. No patient out of 2 were their fracture reduced under bier's block develops CTS. No patient out of 14 their fracture was reduced under G.A develops CTS.

Table 1: Incidence of CTS in Colles' Fracture with different types of Anesthesia and analgesia.

Methods	Percentage of CTS
Hematoma Block	27.5%
Analgesia	8.3%
Bier's Block	0%
GA	0%

Pain is the commonest symptom of CTS which present in 7 out of 11 patients developed median nerve compression (63%). Although pain is not sensitive indicator and liable for subjective variation. Paresthesia was present in 5 patients (46%), Weakness of grip present in 3 (27%), Hypoesthesia present in 1(9%) (Tab4). Tinel test is the commonest positive test presents in 6 patients, the compression (Durkan) test was positive in 4 patients. The Phalens test was difficult to perform because of pain at fracture site. (Some of the patients have more than one complaint).

Electro diagnostic test was positive in 10 patients. The number of patients who develop carpal tunnel syndrome in 48 hours were 3 (27 %), 2 patients in 1 Week (18%) and 1 patient in 1-6 weeks. 5 patients after 6 weeks (45%) in group I. (Tab2) All of those patients were diagnosed by the clinical feature and proved by nerve conduction study and electromyography, however NCS and EMG is not specific for median nerve compression due to hematoma block but since all other factors like fracture itself, deformity, edema of trauma present in both groups and only the hematoma block agent is additive factor in first group so it may be the cause of increase incidence of median nerve compression.

Table 2: Incidence of CTS in Relation to Time.

Time	No. of Patients	Percentage
48 hours	3	27%
1 Week	2	18%
1 Week – 6 Weeks	1	9%
6 Weeks	5	45%

4. DISCUSSION

Nerve injury is rare in Colles′ fracture, but compression of the median nerve in the carpal tunnel is fairly common.[17] Carpal tunnel syndrome is one of the most common complications of fracture of distal radius. The incidence varies from (0.07%) to (17%).[18] The majority of Colles' fractures treated by closed reduction; manipulation under proper anesthesia and/ or analgesia was used for reduction. Hematoma block still one of the common methods used by the surgeon for closed reduction of Colles' fracture. However, others used Biers block, conscious analgesia and general anesthesia.[19,20] In our study we tried to correlate the prevalence of neurological complication (carpal tunnel syndrome) in Colles' fracture reduced under hematoma block with other methods. The incidence of CTS with Colles' fracture reduced under hematoma block was 27.5%, which is comparable to the study of Kongsholm J, Olerud C. which was 25.9%. While the incidence of CTS in Colles' fracture reduced under analgesia in our series was 8.3% compared to 6.4% in Kongsholm study, (Table 3).

Table 3: Comparison of CTS Incidence in our, Kongsholm and Oleured study.

Studies	Hematoma block	Conscious analgesia
Our study	27.5%	8.3
Kongsholm & Oleured	25.9%	6.4%

Despite aspiration of some of the blood of hematoma associated with fracture no more than one ml of blood can be aspirated. Injection of local anesthetic into hematoma of Colles' fracture increase the carpal tunnel pressure for this conclusion to be more valid, needs accurate assessment of the pressure in the carpal tunnel.[21,22] The trauma itself causes increased carpal tunnel pressure due to edema and bleeding, injection of local anesthetic solution increases the fluid content of the carpal tunnel and raises the pressure. In our study there is no any case of CTS complicate, Colles' fracture which was reduced under Bier's block. or G.A. which may be due to the small sample of patients caused by difficulties in subjecting the patients to this type of anesthesia, or it may be due to the fact that Biers block is superior to hematoma block in respect to the fact that it is the method of choice for Colles' fracture requiring manipulation and

immobilization because it does not increase pressure in the area as hematoma block.[23] To decrease the bias in the study, the groups should be more homogenous and the bier′s block and general anesthesia as methods under which Colles′ fracture is reduced better to be isolated as other groups or other study. The incidence is higher in first two days due to edema, bleeding of the fracture, injection of local anesthetic and volar flexion and ulnar deviation in which the fracture immobilized decrease the space in the carpal tunnel, which also increases the pressure and causing CTS symptoms and signs, this also agreed by Kongsholm and Olerud for this conclusion to be more specific it needs accurate assessment of the carpal tunnel geometry and size by CT scan in correlation with Colles fracture in different position.[24] Another peak of the incidence occurs after 6 weeks, this is secondary to the scaring and fibrosis caused by local injection and the increase in pressure. There is a noticeable increase in the incidence of neurological complication in patients with other underling disorder. It is higher in diabetic and hypertensive patient this is probably because these disorders increase the susceptibility of the nerve to the effect of pressure and trauma and they are a cause of CTS by themselves, disregarding the trauma or the local injection of anesthetic however this association of diabetes or hypertension with CTS need to be studied alone to prove this association.[22] Although electro diagnosis is a sensitive diagnostic indicator but it should not be used as an alternative to a careful history, and physical examination and it is useful in objecting and confirming the clinical impression and assessing the severity of involvement. We used any symptom or sign of CTS for inclusion of the case in our study with positive nerve conduction study and electromyography some idea about nerve compression can be obtained by NCS and EMG in 2-3 days but confirmed diagnosis after 3 weeks.[22] Pain is the commonest symptom (63%) fallowed by paresthesia (46%), grip strength loss (27%) then hypoesthesia (9%) which compared to Martinez et al (35); 1993 demonstrated that pain is the commonest (50.8%), paresthesia (49.4%), weakness (17%) hypoesthesia (15%). (Tab4)

Table 4: Incidence of symptoms of CTS in various studies.

Studies	Pain	Paresthesia	Grip Strength	Hypoesthesia
Our study	63%	46%	27%	9%
Martinez et al	50.8%	49.4%	17%	15%

Most of the criteria we depend on are subjective so it is better to depend on objective signs like vibrometry, two-point discrimination and monofilament test by these tests we can decrease the false negative and false positive, however these tests required patient cooperation and understanding of these test. The process of randomization could be better if multiple surgeons examine the patient blindly without knowing the one with Colles′ is fracture. Also, age, sex, side and fracture pattern according to classification systems are better to be stabilized to decrease the bias of the study.

CONCLUSION AND RECOMMENDATION

CTS is a common complication of Colles' fracture and every surgeon should carefully look for symptoms and signs of CTS, immediately and in every visit – during follow up of Colles' fracture. In view of the rather frequent occurrence of this complication it is recommended that all patients with Colles' fracture be carefully evaluated clinically and that all suspected cases be referred for early electro diagnostic study. The incidence of CTS in Colles' fracture reduced under local infiltration is significantly higher than other methods of analgesia or anesthesia. it is suggested to limit the use of Hematoma block for reduction of Colles' fracture in the patients who have contraindication to other form of anesthesia.

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