



displacement and comminuted) middle third clavicle fracture were included for this study after taking written consent from them.

**Exclusion criteria:** Patients less than 18 years of age, Patients not willing for surgery, very old aged persons and Patients medically unfit for surgery were excluded. General information like name, age, sex, occupation and address were noted. Then a detailed history was elicited regarding mode of injury like fall on the shoulder, Road traffic accident, direct injury to shoulder and fall on outstretched hand. Enquiry was made to note site of pain and swelling over the affected clavicle. Past medical illness and family history were also recorded. General condition of the patients was examined for pallor, pulse rate and blood pressure. Respiratory and cardio vascular system were examined for any abnormalities .consent for surgery taken.

**Operative Method:** Patient was taken for surgery under GA, in supine position. A cushion was pushed underneath the fracture side shoulder .Longitudinal incision made along centering the fracture site, fracture exposed and 1.25mm Guide wire was passed from Inferio-medial to superior-lateral direction so as it to pass about one inch either side away from fracture line. Cannulated drill of 2.5mm was mounted over guide wire to drill both sides, and then fragment was reamed with 3.5 mm Tap. Insertion point was over drilled inferio-medially. Then one Cannulated screw(with core dia 2.5mm,thread dia 4mm,shaft dia2.7mm, cannulation1.35mm,head dia 5mm) with length variation from 50mm to 65mm length was used. The cannulated screw slowly threaded over guide wire. Fracture ends would approximate as this screw traverses-in, giving Lag effect at fracture ends (Fig.1). Few fractures had comminution at fracture site with large fragments. In these fractures, after Cannulated Screw insertion large fragments were approximated by encirclage wiring (Fig. 2 & Fig 3). Whereas those with small pieces were left as such by the side as graft. Shoulder Arm immobilizer was used post operation.

**Post Operative care:** Patients were kept nil orally for 4 to 6 hours post-operatively. Intravenous fluids were given as needed. Antibiotics were continued for 10 days. Analgesics and tranquilizers were given according to the needs of the patient. The operated upper limb was immobilized in an arm pouch for simple fractures and shoulder immobilizer as advised for comminuted fractures .Check x-rays were taken to study the alignment of fracture fragments. The wound was inspected at 3or 4th postoperative day. Suture removal was done on 10th postoperative day. Patients were discharged with the arm pouch.

Rehabilitation of the affected arm was started at the end of 2 weeks. Gentle pendulum exercises to the shoulder in the arm pouch were allowed from next morning. At 4 to 6 weeks gentle active range of motion of the shoulder was allowed but abduction limited to 80 degrees. At 6 to 8 weeks active range of motion in all planes were allowed.

**Follow up:** Regular follow up for every 4 weeks was done. Local examination of the affected clavicle for tenderness, instability deformity and shoulder movements were assessed (Fig 4). X-rays were taken at each follow up visits to know about progressive fracture union and implant position. Rehabilitation of the affected extremity were done according to the stage of fracture union and time duration from day of surgery. Patients were followed up till radiological union. The functional outcome was assessed by Constant and Murley3 score.

#### 4. Results and Observations

The present study consists of 28 patients of fresh fracture of the clavicle which were treated surgically with cannulated screw for middle third clavicle fracture between July 2012 to April 2014. Following observation are made in our study .In this present study there were 28 patients All the patients in middle third clavicle fracture were closed type and displaced fractures. There were no associated medical illnesses in any patient. In middle third clavicle fractures direct injury occurred due to fall on shoulder while slipped over floor outstretched hand and injured4(14%); fall from two wheeler in 8(29%), fracture due to road traffic accident 12(43%), due to fall of object over shoulder 3(11%)and 1(3%) by assault injury(Table 2).

Majority of the patients with middle third clavicle fracture i.e.16 patients (57%) were in the age group of 18-29.; while 8(29%) patients were between age group 30-49 and rest 4(14%) were over age of 50 years. The youngest patient was 18 years and oldest patient was 59 years. The average age of patient was35.65 years .In middle third clavicle fracture majority were males, 18 (64%) patients and 10((36%).females (Table 1). In this study for middle third clavicle fractures there were 16 patients (57%) of right sided and 10patients (36%) of left sided and 2(7%)patients has fracture of both clavicles.(Table3).In middle third clavicle fracture 8 patients (28%) had associated injuries, among them 2 patient (7%) had scapular body fracture and 3(11%) patients had associated rib fracture,2 (7%) had Head injury and one patient had multiple fractures All the Patients were immobilized in an arm pouch. we followed Robinson's AO classification, There were no type-1 (medial third)or Type3(lateral third) fracture. In type-2 middle third fracture type-2 B1 (displaced with simple or single butterfly fragment) occurred in 20patients (78%) and type -2 B2 (displaced with comminuted or segmental) fracture occurred in 8 (32%) patients(Table3). All the patients were fixed with single Cannulated Lag screw. Since 8(32%) patients had either comminution or fragment was large to approximate, after fixation with cannulated screw it was reinforced with encirclage wiring for better approximation.

**Duration of Union,** The fracture was considered to be united when clinically there was no tenderness, radiologically the fracture line was not visible and full unprotected function of the limb was possible .In middle third clavicle fracture 20 patients (72%) united at the end of 12 weeks. In 6 patients (21%) union occurred by 16 weeks while2(7%) patients required immobilization for

more than 18 wks due to large butterfly fragment at fracture site, which united at >20 weeks (Table 5). Removal of the Screw was advised at the end of 1 year. Patient was explained that screw can be removed as a day care procedure but most of them were satisfied or unwilling for second surgery as they were not having any problems. only 6 patients implant removal done One patient Screw was protruding proximally and distally at fracture site and patient was feeling disturbed, so removal was done by 9<sup>th</sup> months after operation (fig 5).

## 5. Complications

Surgical procedure fixation by single cannulated screw is relatively safe procedure. We did not had any major complications except few minor ones (Table 4). In middle third clavicle fixation 3 patients (10.7%) had hypertrophic skin scar and in 4 patients (14%) prominence of screw head medially, in one (3%) prominence occurred both proximally and distally and we removed this screw by the end of 9 months and arm sling given for 4 weeks. In this patient painful restriction of shoulder movements occurred and later it resolved with physiotherapy. No non union occurred. Superficial infection occurred in 3 patients (10.7%), which was treated with oral antibiotics for 5 days and in another 5 patient (18%) restriction of shoulder movements occurred due to associated scapular and multiple rib fractures where immobilization was extended for few more weeks, but it recovered after mobilization exercises of shoulder. The functional outcome is assessed by Constant and Murley score. In this study on 22 patients (79%) with middle third clavicle fracture treated with Lag screws had excellent functional outcome, good functional outcome in 4 patients (14%) and fair functional outcome in 2(7%) patient (Table 6).

## 6. Discussion

Clavicle fractures are usually treated conservatively. In a study conducted to analyze the results of conservative treatment by Hill et al, Nordqvist et al.4 and Robinson et al.5 found poor results following conservative treatment of displaced middle third clavicle fracture. Multi centre trial by Canadian trauma society<sup>6</sup> compared result of conservative treatment with plating which was associated with implant failure. Other study by Conservative treatment of displaced lateral third clavicle fracture has higher rate of non union and residual shoulder dysfunction as showed by Edwards et al.7. In this present study middle third clavicle fracture patients with Robinson Type-2 B1 (Displaced with simple or butterfly fragment) were more common and there were 20 patients (71%). Type-2 B2 (displaced with comminution) occurred in 8 patients (29%). In Bostman et al.8 study, also found that middle third clavicle fracture Robinson type-2 B1 was common in 78.64% patients whereas Robinson type-2 B2 occurred only in (21.36%) patients. In our study the middle third clavicle fractures were fixed with single Cannulated screw as Lag fixation and no plate was used. It provides stable fixation at fracture site and unlike Plate it does not require pre contouring. With our fixation there is minimal tissue trauma. Since screw head is deeply secured infero-medially, no protuberance as is with plate and least chance

of loosening. Screw fixation is very cost effective as compared to plate. In this study majority of the middle third clavicle fracture 20 patients (72%) united at the end of 12 weeks. In 4 (10%) patients fracture took longer period to unite. It was due to large butterfly fragment at fracture site which united by 16-20 weeks. There were no non-union. Lazarus MD<sup>9</sup> stated radiological union occurred approximately between 6 to 12 weeks. In Kao et al<sup>10</sup> series union occurred after an average period of 4 months. Bostman<sup>8</sup> series had similar union. In our study 72% middle third clavicle fracture fixed with Lag screw united by 12 weeks while rest took 4 to 6 weeks more period depending upon comminution at fracture site.

## 7. Conclusion

Clavicle fractures are usually treated conservatively but there are specific indications for which operative treatment is needed like comminuted, displaced middle third clavicle fractures.

- Among the fixation methods intra medullary fixation by K-wire do not control rotation so they require longer period of immobilization till union.
- Plating at mid third fracture requires pre contouring and chance of soft tissue trauma and loosening of implant is more, also cosmetically unacceptable
  - In this study primary open reduction and internal fixation with Cannulated screw fixed with Lag effect in fresh middle third clavicle fractures, provides a more rigid fixation and does not require immobilization for longer periods.
  - In this study Lag screw fixation provide stable fixation without disturbing blood supply due to minimal tissue handling and blood supply preservation due to placement of Lag screw inside medullary cavity of fractured clavicle.
- This does not require pre contouring like plate nor there is chance of loosening as often happens with plate fixation
- All the fractures united and there were no non union or major complications with fixation by Single cannulated screw.
- This method of fixation has been performed with small sample size. Further evaluation and Modification is expected in due course with broader perspective, to be accepted as standard method of mid third clavicle fixation.

## Bibliography

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**Clinical Photograph**



**Figure 1:** Mid third fracture clavicle fixed with lag screw.(Type2 B1)



**Figure 2:** Comminuted mid third clavicle fracture with large intermediate fragment fixed with cannulated screw and encirclage wire(Type2 B2)



**Figure 3:** Comminuted fracture mid third Clavicle fix with single cannulated screw and reinforced with three encirclage wiring

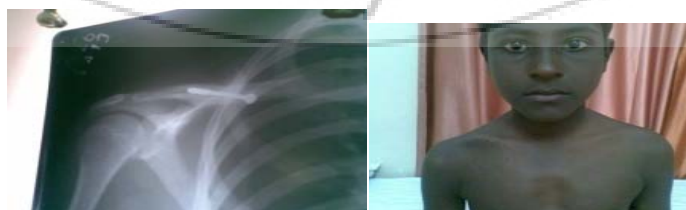




Figure 4: Post operation --showing full range of motion



Figure 5: Showing cut through of screw and collapse at fracture side. Sling immobilization continued and fracture united

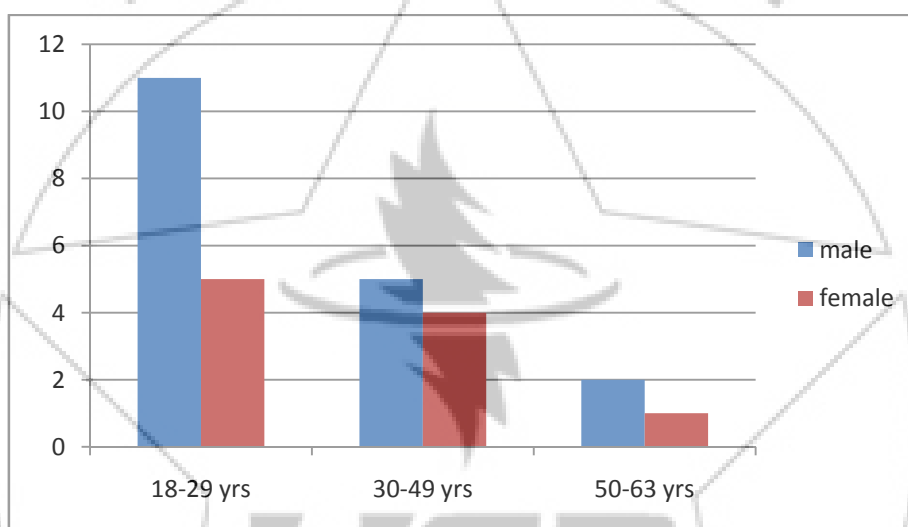


Table 1: Age and Sex distribution of mid1/3 Clavicle fracture

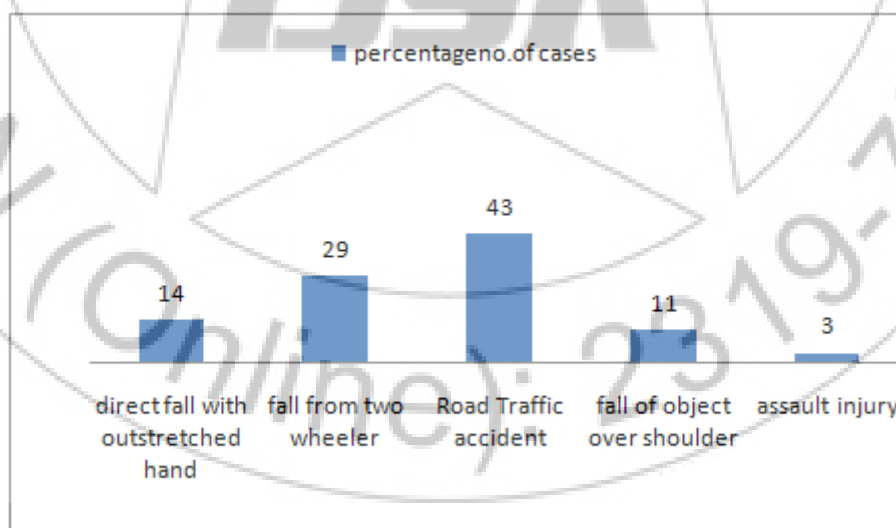
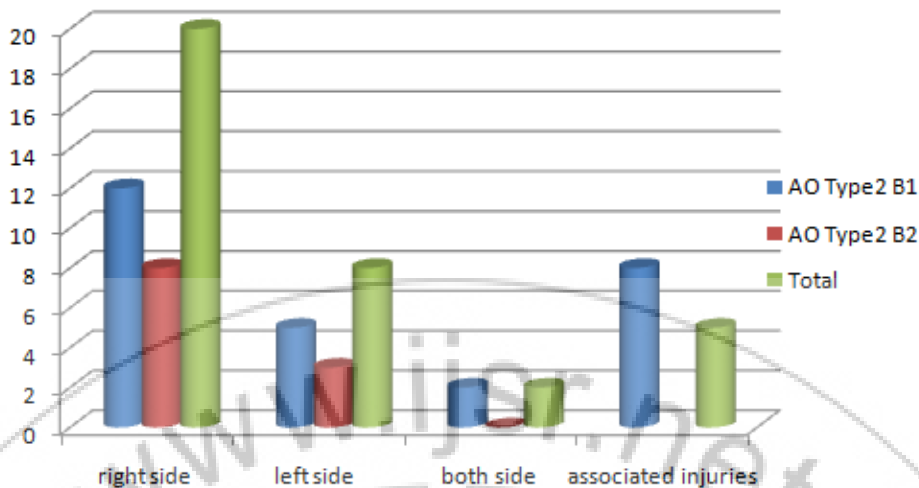
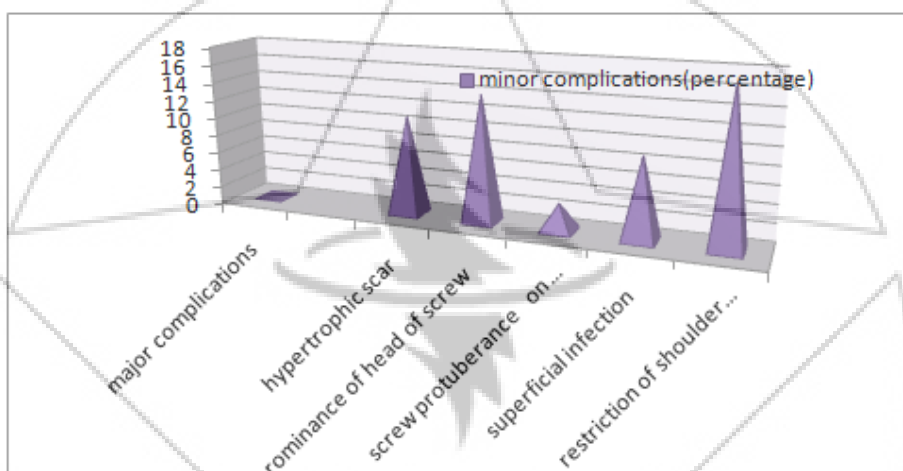


Table 2: Showing Mode of Injury

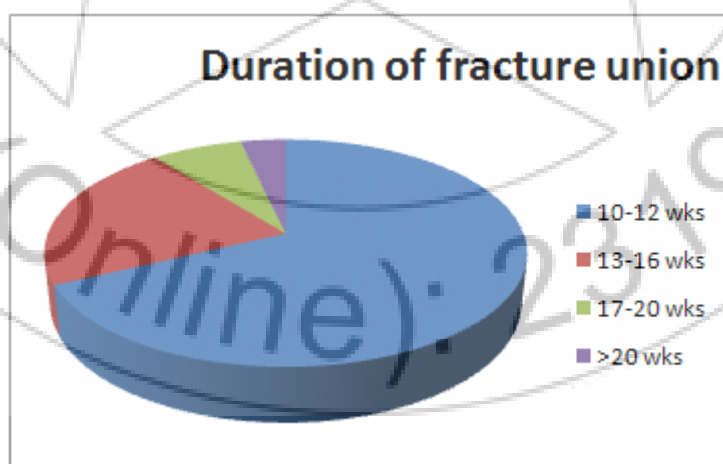


**Table 3:** Distribution of type AO fracture (Robinson's Classification) and its site



**Major complications-nil**  
**Minor complications(16 cases)**

**Table 4:** Complications following Lag Fixation



**Table 5:** Showing duration of fracture union.

**Table 6:** Range of Motion of shoulder after surgery

|  |         |
|--|---------|
| Full movement                              | 22(79%) |
| Terminal restriction of abduction/rotation | 4(14%)  |
| Restriction of all movements               | 2(7%)   |