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A study of functional outcome of percutaneous fixation of unstable pelvic fractures

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Abstract

Background: Pelvic ring injuries are commonly encountered in high energy trauma, representing one of the most challenging clinical problems in which an urgent multidisciplinary the approach is required. Pelvic fractures are the third most common cause of death in road traffic accidents, following central nervous system and chest injuries. Pelvic injuries are a source of significant morbidity and mortality with rates ranging from 5 to 20%.

Aim: To study the functional outcome of percutaneous fixation of unstable pelvic ring disruptions.

Materials and Methods: 20 patients admitted in government thoothukudi medical college hospital thoothukudi with pelvic injuries with unstable type B and type C were included in this prospective study. All the patients were treated based on our inclusion and exclusion criteria. Only Tiles B and C fractures were included in this study.

Results: 20 patients with pelvic fractures admitted at Government Thoothukudi medical college hospital, Thoothukudi were included in the study. The mean age was 37.5 yrs. The age group between 31 to 50 dominates the series accounting for 64% of cases.

Pelvic fractures caused by road traffic accidents include 17 fractures (85%) and accidental fall 3 fractures (15%).

The average time from injury to surgery was 14 days (range 4 to 28 days), our mean operative time was 45 minutes. All the patients were treated with percutaneous fixation with cannulated cancellous screws.

All patients were regularly followed up once a month for three months, then at three months interval there after. Standard antero posterior xray, lateral, and axial CT views were taken at discharge, 3months, at the end of one year and at latest review.

5 out of 20 patients had complications associated with surgery. One patient had wound infection and had to undergo implant exit. Two patients had fracture mal reduction in the postop radiograph showing persistent displacement of fracture fragments. However, this did not alter the functional outcome significantly.

Two patients had screw malposition on postoperative CT scan with violation of neural foramen. However this did not result in neurological deficits.

Functional evaluation was done using Majeed pelvic injury functional outcome score. All operated cases were followed up for maximum period of two years and minimum of one year.

The Majeed pelvic injury functional outcome score at the end of one year is excellent in 12 cases (60%), good in 5 cases (25%), fair in 3 cases (15%) and poor in no cases. The average score was 80% among all patients at the latest follow up.

Conclusion: Percutaneous screw fixation for pelvic fractures is in our opinion, a reliable and reproducible technique. Functional outcome in our study was good to excellent in 85% of cases as per the majeed pelvic scoring system. The score is found to be significantly higher in those cases without associated lower limb or spine fractures showing the impact on delayed weight bearing in associated fractures.

Keywords: pelvic fractures, percutaneous fixation, cannulated cancellous screws

Introduction

Pelvic ring injuries are commonly encountered in high energy trauma, representing one of the most challenging clinical problems in which an urgent multidisciplinary approach is required. pelvic fractures are the third most common cause of death in road traffic accidents, following central nervous system and chest injuries. Pelvic injuries are a source of significant morbidity and mortality with rates ranging from 5 to 20%.

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Inclusion Criteria

Tile B and C types (unstable type)
 SI joint disruption > 0.6 cms
 Vertical migration of hemipelvis > 1cm
 Sacral fractures (Tile C 1.3)
 Pubic rami fractures > 15mm displacement
 Pubic diastasis > 2.5cm
 Unstable iliac wing fractures (Tile C 1.1)

Exclusion Criteria

Open Fractures of Pelvis
 Stable pelvic injuries (Tile Type A)
 Injuries in pediatric population

Materials and Methods

The prospective study was done in 20 patients with pelvic fractures treated with internal fixation with cannulated cancellous screw fixation in the department of government thoothukudi medical college thoothukudi between May 2020 and March 2021.

All patients were treated based on inclusion and exclusion criteria. Only Tiles B and C Type fractures were included in the study.

All the patients selected for study were examined according to protocol, associated injuries noted and clinical and lab investigations carried out in order to get fitness for surgery. Consent of the patient taken for surgery. Patients were followed till Union was achieved clinically as well as radiologically. Patients underwent a pre-operative evaluation including the following parameters: Hb, blood sugar, RFT, Xray - AP, LAT, Judet views and CT pelvis axial and coronal views with 3D Reconstruction done.

Mode of Injury

Road traffic accidents; 17
 Accidental fall; 3

Associated Injuries

Upper Limb Fractures; 6 cases
 Fractures of Lower Limb and Spine; 7 cases
 Urethral and bladder injuries; 4 cases
 Blunt injury abdomen; 3 cases.

Age and Sex Distribution

20 patients were operated of which 16 were male and 4 female.

Pre-Operative Assessment

All patients were evaluated using the radiological methods {xray AP and inlet and outlet views, CT scan axial and coronal views with 3D reconstruction. and classified using Tiles classification.

Initial hemodynamic resuscitation and Pelvic binder support was given to all patients waiting for surgery. Skeletal traction was applied in vertically migrated pelvic fractures to obtain and maintain reduction pre operatively.

Implants

6.5 mm partially threaded (16/32 mm) cannulated screws.
 3.5/4.5 mm recon plate, 1/3 rd tubular plate
 K wires, Cannulated screw system



Fig 1: Implants and Instruments

Timing of Surgery

All patients were operated within 3 weeks of injury, ranging from 3 to 21 days from the time of fracture. The mean duration was 12 days. Other associated injuries indicated for surgery were also operated in the same sitting.

Anesthesia and Position

Surgery was done in standard operating radiolucent table with patient in supine or prone position with a sand bag placed posteriorly to allow the buttocks to hang a little. Spinal anaesthesia was given in all patients. Image intensifier was placed opposite to surgical site for free movement. After skin preparation drapes are tucked under the patient's buttock to allow full access for the entry point.

Surgical Technique

For Percutaneous Iliosacral Screw Fixation a true lateral view of the sacrum should be obtained and the entry point for the screw identified using the tip of a wire to point out the center of the sacral alar, proximal to S1 level.

Lateral view of sacrum for identification of entry point based on overlap of sacral ala and greater sciatic notches of both sides (from Laude and Paillard series of 20 cases)

On AP view, entry point is made on the intersection of line drawn parallel to femoral shaft and perpendicular to ASIS. This point is then incised and a wire introduced by hand and held against the bone using a Kocher. Once correct placement of tip of wire is confirmed, the AP, inlet, and the outlet views are taken. The wire is then slowly introduced using power. As soon as the hard subchondral bone of the ilium at the SI joint is encountered, the trajectory must be rechecked in all the three views.

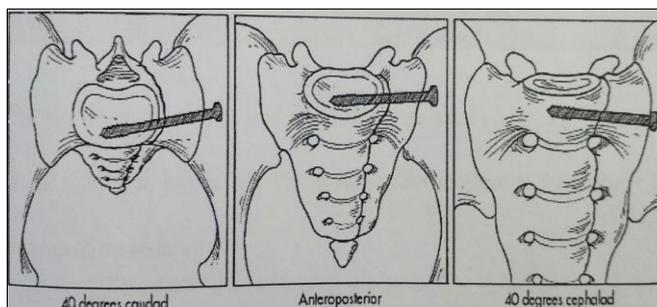


Fig 2: Confirmation of screw position

Confirmation of position of screws on AP, 40°cephalad and 40°caudal views. (From JBJS review article on percutaneous fixation of pelvic ring, 2007)

If the trajectory of the wire is unsatisfactory, it is helpful to leave the wire in place, allowing the surgeon to reference from it and also preventing the new wire from following the same path.

The wire should cross the SI joint, head towards the center of the body of sacrum on the inlet view, and be midway in the corridor proximal to the S1 nerve root foramen on the outlet view.

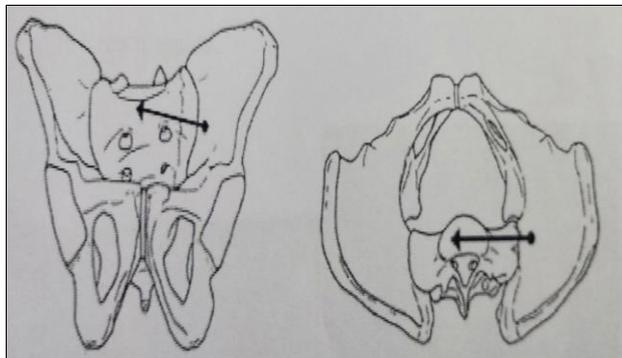


Fig 3: Iliosacral screw trajectory

Trajectory of iliosacral screws (from JBJS review article on percutaneous fixation of pelvic ring, 2007)

Dense bone is encountered on the sacral side of the SI joint. The surgeon should be aware that further dense bone could represent the wire exiting the sacrum anteriorly, penetrating into a nerve root canal, or even into the sacral canal.

A second screw can be inserted in the same manner, if required for additional stability. but for pelvis of Indian population the width of S1 usually allows only one screw insertion. wound is washed and closed with a single skin stitch.

For pubic rami fixation, for antegrade screw insertion, the patient is prepared and draped as for anterior stabilization and as if percutaneous SI screw fixation were to be performed. the line from the tip of the trochanter to the thickest part of the iliac crest is drawn out, this lies 4 to 5 cms posterior to ASIS.

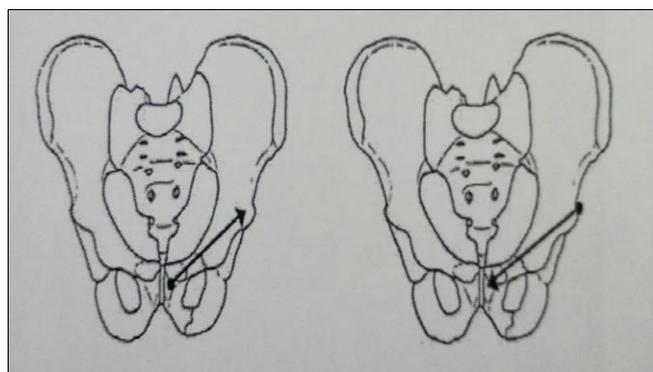


Fig 4: Retrograde and antegrade screw trajectory

Trajectory of retrograde and antegrade superior pubic ramus screws. (From JBJS review article on percutaneous fixation of pelvic ring, 2007)

A small stab wound is made a little proximal to the mid point of line and the guide wire introduced. once the trajectory is confirmed the wire is advanced, with repeated screening throughout. Again encountering dense bone warns of penetration of the joint, the inner, or the upper cortex. leaving

the unsatisfactory wire in place is usually helpful as with the SI screw technique.

Retrograde screw insertion is performed via a 3cm anterior “Mini Pfannensteil” incision and the entry point is just inferior to the pubic tubercle. Guide wire insertion proceeds in the same manner as above, initially aiming below and beyond the anterior inferior iliac spine.

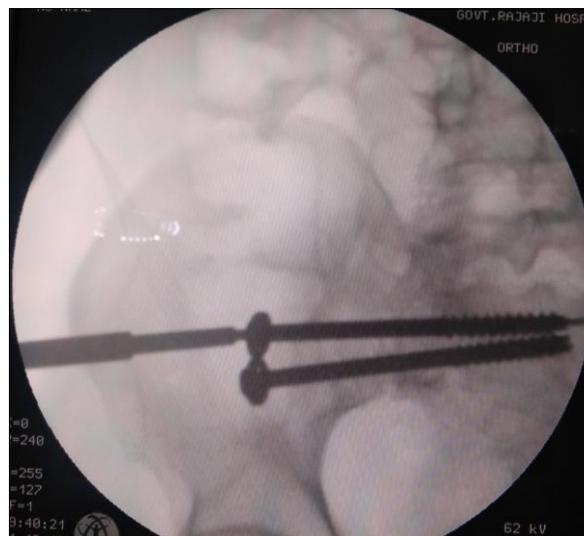


Fig 5: Iliosacral screw fixation



Fig 6: Superior pubic ramus screw fixation

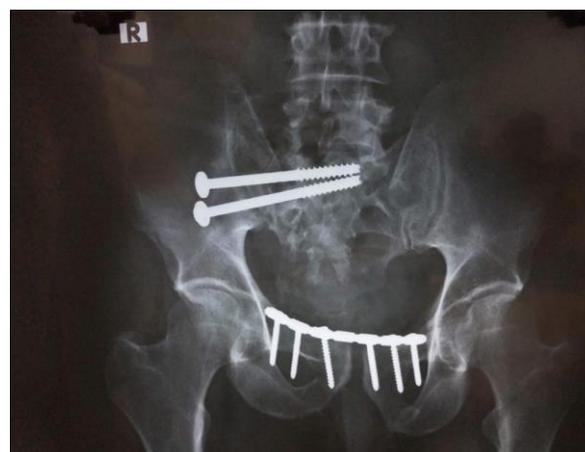


Fig 7: Iliosacral screw fixation and pubic diasthesis plate fixation

Iliac Wing

Percutaneous fixation is limited by the anatomy of the bone but may be applied at the pelvic brim and iliac crest, thus precluding deep surgical exposure of the iliac fossa. A 6.5 to 7mm medullary screw is inserted at the anterior inferior iliac spine and passed above the greater sciatic notch into the posterior iliac spine. Thinner screws may fail and bend leading to loss of reduction. Comminuted fractures of the ilium are not suitable for this technique and require stabilization by plated and screws.

Postoperative Protocol

All patients were allowed to sit up on the bed on 2nd day of surgery, once the pain subsides. Patients were kept on non-

weight bearing mobilization for 6 weeks, and partial weight bearing up to 12 weeks. Full weight bearing is allowed after 12weeks.

Follow Up Protocol

All patients were regularly followed up once a month for three months, and three months interval there after. standard AP and lateral xrays, and axial CT views were taken at discharge, 3 months, and at the end of one year. Functional outcome was done using majeed pelvic injury functional outcome score. All patients were followed up for a period of minimum one year and maximum 2 years.

Observation

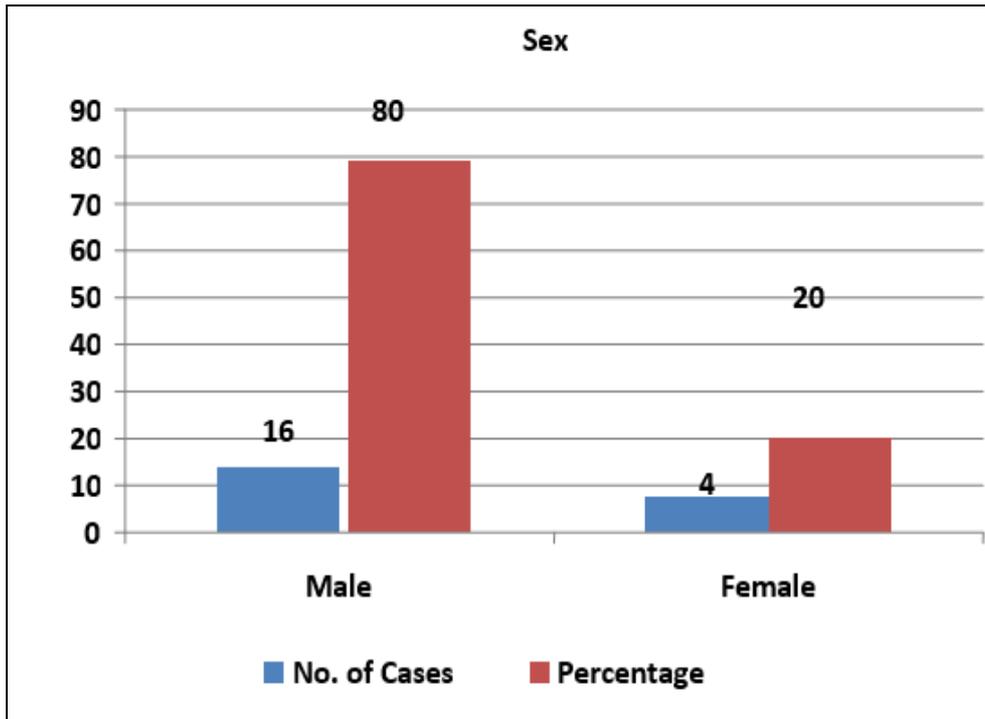


Fig 8: Sex

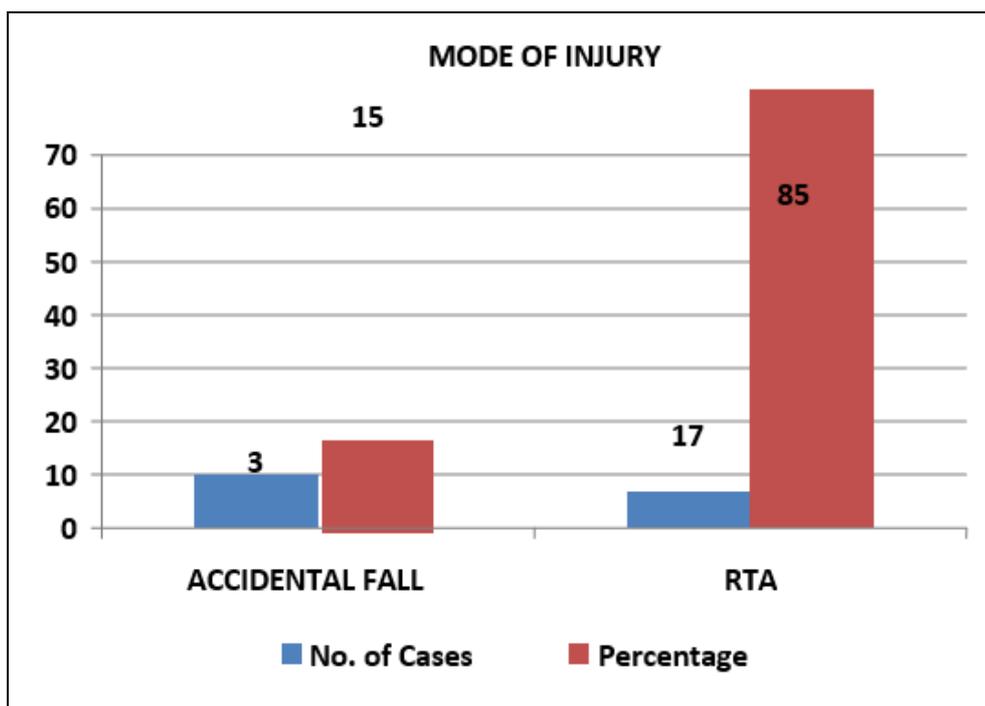


Fig 9: Mode of Injury

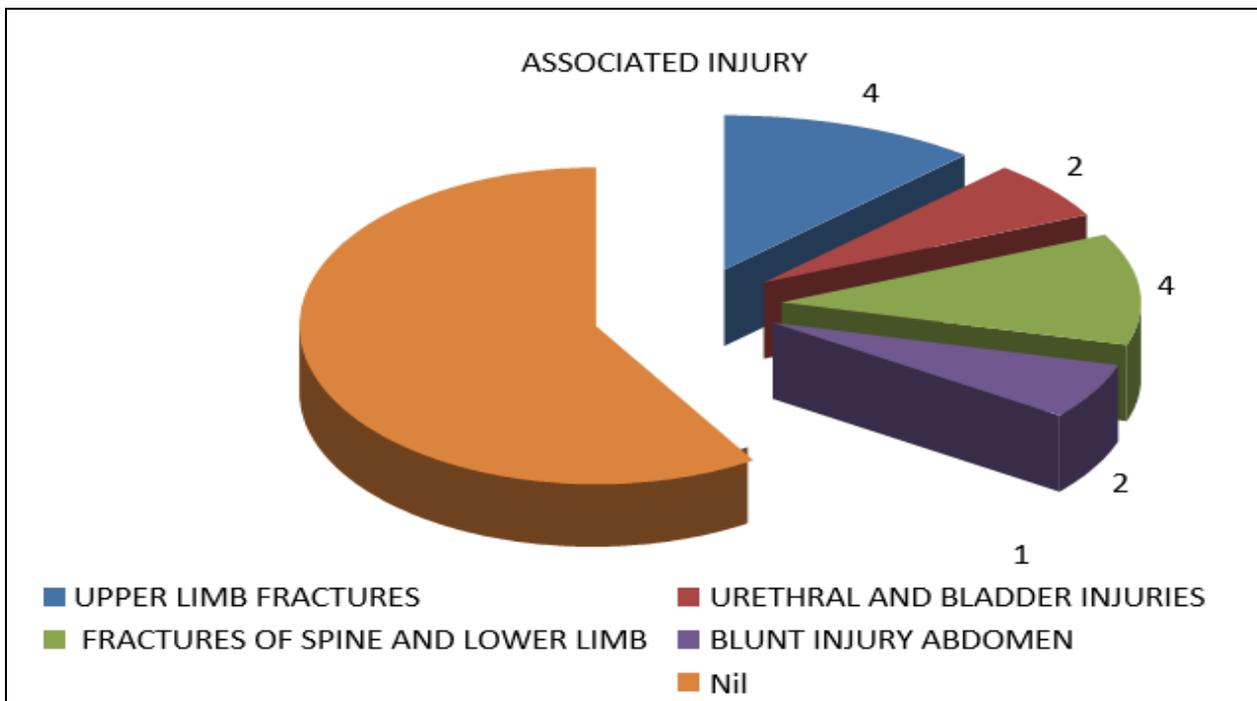


Fig 10: Associated Injury

Discussion

unstable pelvic ring disruptions occurring in poly trauma has become a major focus of interest as it occurs as a part of the spectrum of polytrauma and considered a potentially lethal injury with mortality rates of 10 % to 20%. unstable pelvic ring stabilization in multiply injured patients is now conveniently followed. Pennal *et al.* in their study of 359 cases concluded that patients with unstable pelvic ring fractures showed many late complications during follow up. Pelvic stability not only depends on the bony structures but also on the strong ligamentous structures binding together the strong bones of pelvis. Tiles pelvic classification is based on the pelvic stability, the fractures at the stable end are type A, at the unstable end are type B, the integrity between the posterior weight bearing sacroiliac complex and the pelvic floor determines the pelvic stability. the posterior sacroiliac complex is a strong biomechanical structure which is able to withstand the weight transfer from the spine to lower extremities.

A completely unstable pelvic ring may be caused by complex fractures. pelvic trauma depends on the degree of violence, the type of injury, the method of treatment, and the presence or absence of complications such as urethral tear, permanent nerve damage, malunion, malreduction of the sacro iliac joint and non-union.

In early 1990s, Routt and associates reported the use of percutaneous fixation to stabilize posterior injuries involving the sacroiliac joint in large series of patients. Routt reported a low complication rate. low operative time, and minimal blood loss. Despite the low complications surgeons were slow to accept this technique. But with improvements in intra operative imaging and increased familiarity with percutaneous techniques, this has now become a common treatment for posterior pelvic injuries.

Percutaneous techniques were introduced with the aim of decreasing morbidity and mortality of the patient. one screw is adequate for most sacroiliac injuries. For unstable patterns two screws can be applied.

For iliac wing fractures and sacroiliac fracture dislocations, starr *et al.* concluded in their study that percutaneous

technique is also very useful and the technique of insertion of screw is straight forward and is free of major complications. Also they concluded that superior pubic ramus screw insertion percutaneously is a safe adjunct to posterior pelvic ring fixation, with low risk of damage to surrounding vascular, neurological and visceral structures and low morbidity.

This series of pelvic injuries show very low rates of malreduction, low operative time, and minimal blood loss. for example, Routt and associates reported on a series of 103 percutaneously placed sacroiliac screws. Their mean operative time was 29 minutes, with a mean blood loss of 10.2 ml, Postoperatively, there were 12 malreductions, most of which occurred in the Tile Type C injuries. there were no reported nonunions or infections at 12 months.

Recent studies have also compared mechanical properties of percutaneous fixation versus traditional plating techniques. In a recent study, the stiffest construct in a single limb stance simulation was created with two ilio sacral screws.

Dujardin *et al.* in their study of 88 patients with Tile B and C injuries found that accuracy of reduction had no correlation with functional results for iliac wing fractures or sacroiliac fracture dislocations. the authors also noted that in pure sacroiliac dislocations, an anatomical reduction and fixation correlated well with better functional outcome according to the Majeed pelvic scoring system.

Mullis *et al.* in their study concluded that screw fixation after an anatomical reduction of the sacroiliac joint will improve the functional outcome in patients with vertical shear pelvic injuries associated with pure sacroiliac dislocations.

Thus in hands of expert surgeon, sacroiliac disruptions can be fixed using percutaneous techniques.

Results

20 patients with pelvic fractures admitted at Government Thoothukudi medical college hospital, Thoothukudi were included in the study. The mean age was 37.5 yrs. the age group between 31 to 50 dominates the series accounting for 64% of cases.

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