

## Outcome of plate osteosynthesis in pubic diastasis: an experience of tertiary care centre

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### Abstract

**Background:** Pubic diastasis results from high energy trauma and is often component of polytrauma. When diastasis is >2.5 cm these are unstable fracture and needs fixation. We share our outcome in management of type II & III APC at our tertiary care centre.

**Methods:** A total of 15 patients were selected from 23 patients presenting in a year span for study fulfilling our inclusion exclusion criterion. We fixed all type II APC injury patient with single anterior plating and type III APC with anterior plating and posterior sacroiliac screws. Each patient was followed up for one year for functional and radiological outcome.

**Results:** Among the 15 patients, there were 9 APC II & 6 APC III injuries. M: F ratio was 11:4. Functional outcome was excellent in 7 (47%), good in 6 (40%) and fair in 1 (13%) patient. Radiological scores were excellent in 6 (40%), good in 5 (33%), fair in 2 (13%) and poor in 2(13%) patient. No patients had implant failure.

**Conclusions:** We believe single anterior symphyseal plating alone in APC II and additional sacroiliac screw fixation in type III APC injuries provide adequate stabilization.

**Keywords:** Pubic diastasis, Plating, Sacroiliac screws

### Introduction

Pelvic fractures commonly occur from high velocity injuries like motor vehicle accident, industrial injury, fall from height and are associated with significant morbidity.<sup>(1)</sup> Pubic diastasis accounts for 13%-16% of these injuries.<sup>(2)</sup> Young and Burgess have sub-classified them as APC (Anterior-Posterior Compression) injury wherein an external rotatory force splits wide open the hemipelvis- the so called "open book injury" often with tear in the posterior ligaments or fracture of the posterior ilium/sacrum.<sup>(3)</sup> Unstable pelvis usually requires surgical treatment of the anterior ring and sometimes even the posterior ring if disrupted. Several modes of fixation have been described to stabilize these injuries.<sup>(4-7)</sup> This present article describes the outcome of 15 patients of APC II & III, in whom plate osteosynthesis was used.

### Materials and methods

This study is a retrospective analysis of 15 patients of pubic diastasis from a total of 23 patients who had presented to our hospital in a span of one year from June 2014 to June 2016. Ethical committee approval and written informed consent was taken from the patients. At admission immediate resuscitation and a primary surveillance were done. Any associated injuries were managed accordingly. After stabilization all patients had undergone a standard antero-posterior roentogram and inlet and outlet view. Computerized tomogram (CT scan) was done for better delineation of sacroiliac injury whenever possible. Pubic diastases were graded according to Young and Burgess. Patients with type I APC (managed conservatively), open pelvis fractures, associated acetabular fractures were excluded from the

study. All patients underwent open reduction and internal fixation with a plate which was applied superiorly or anteriorly as per surgeon's preference and additional percutaneous iliosacral screws in SI disruptions (type III).

### Surgical method and post op protocol

Patients were placed supine and Pfannenstien incision was used. Reduction was achieved with pointed reduction clamps which were applied anteriorly. The plate was either applied first superiorly or anteriorly (**Fig. 1**). In case of APC III injury percutaneous 6.5 cannulated screws were given after confirming in lateral, AP, Inlet and Outlet views in fluoroscopy. Post-operative patient received IV antibiotics for 72hours and monitored for any unwanted complications like infection, DVT. Active hip and knee exercises were started on third post-operative day. Assisted weight bearing with the help of walker was started as patients pain subsided (usually by 5-8 days) after the surgery. Full weight bearing without crutches was allowed after 12 weeks. Low molecular weight heparin (LMWH) was administered subcutaneously for 7 days and oral Ecosprin after that for a period of 3 weeks. Patients were treated for any complication noted in post op period and discharged after removal of sutures. Patients were followed up at 3rd, 6th and 12 months time for functional (Majeed scoring) and radiological assessment.



**Fig 1: Intraoperative picture showing Phemmerstein incision and plating superiorly. The plate is contoured and applied after retraction of bladder**

### Results

Among 23 patients 8 were excluded (5 had APC I which were managed conservatively, 2 had associated acetabular fractures, 1 had isolated SI disruption- **Fig. 2**) and 15 were followed up. There were 11 males and 4 females. 9 patients were APC II and 6 patients had APC III injuries. Patients with type II injury were operated for pubic diastasis with plating (superior: anterior – 6:3 using 3.5 DCP/recon plate contoured accordingly) as shown in **Fig. 3a, b**. Those with APC III injuries were managed by plating first with additional percutaneous sacroiliac screws for SI fixation as shown in **Fig 4**.



**Fig 2: Isolated sacroiliac disruption was excluded from the study**



**Fig. 3a: Demonstration of APC type II with plating**



**Fig. 3b: Demonstration of APC type II with plating**



**Fig 4: APC type III which was hemodynamically unstable initially external fixator applied and definitive fixation with anterior plating and sacroiliac screws**

In 9 patients with APC II injuries, functional score was excellent in 5 patients (56%), good in 3 patients (33%) and fair in 1 (11%). Radiological scores in these patients were excellent in 4 patients (44%), good in 3 patients (33%), fair in 1 patient (11%) and poor in 1 patient (11%).

In 6 patients with APC III injuries, functional score was excellent in 2 (33%) patients, good in 3 patients (50%) and fair in 1 patient (17%). The radiological scores in these were excellent in 2 (33%), good in 3 patients (50%) and poor in 1 (17%) patient.

One patient of APC II had presented with pre-operative urethral injury that was managed by immediate supra-pubic cystostomy & same sitting plating (owing to risk of infection after 48 hours which is unacceptably high). The urethral repair was done at follow up date by urologist and this patient had a fair functional outcome (**Fig. 5**). 2 patients (1 APC II & 1 APC III) had a post-operative infection one of which a 35 year female settled with secondary debridement on day 3 and other was an elderly diabetic who required repeated debridement and eventual implant removal on 9 months had lesser functional and poor radiological outcome. 3 patients had an associated long bones fracture (2 had femur # and 1 had humerus #) of which one was hemodynamically unstable wherein immediate external fixator and later plating with SI screw on day 5.

No implant failure like screw breakage/ plate pull was noted during the course of study. One young female had elective implant removal 16 months post-surgery.



**Fig 5: APC type II follow up having urethral injury for definitive urology management**

**Table 1: Functional and radiological outcome of patients**

	Functional outcome (Majeed)		Total	Radiological outcome		Total
	AP C II	AP C III		AP C II	AP C III	
Excellent	5	2	7 (47%)	4	2	6(40%)
Good	3	3	6 (40%)	3	2	5(33%)
Fair	1	1	2 (13%)	1	1	2(13%)
Poor	0	0	0	1	1	2(13%)

## Discussion

Pelvic injuries are high intensity injuries and many times present in combination of polytrauma.<sup>(8)</sup> It is our dictum and institutional protocol that one has to rule out polytrauma in presentation of pelvis injury, hence we follow overall polytrauma assessment of patient. Owing to significant blood loss, hemodynamic stability should be achieved at the earliest. Diagnostic imaging is undertaken once patient is hemodynamically stable or wherein intervention like vascular embolism is undertaken.<sup>(9)</sup>

Plain radiography (AP, Inlet & Outlet) is suffice for pelvis fracture but additional judets view can be helpful to see acetabular profile. CT of pelvis has many-fold advantage like- maximum pictures in minimum time including a 3D volume rendered view for better assessment; when positioning for Judets view is difficult; better delineation of the SI disruptions particularly in subtle/ complex fractures or obese patients or when bowel are full and aids in determining

conservative/operative management of SI joint.<sup>(10)</sup> Diagnostic imaging also helps in accurate classification of the injuries.<sup>(3)</sup> However diagnostic imaging should not be undertaken unless patient is hemodynamically stable.

While the consensus for pubic diastasis >2.5 cm (unstable fracture-not able to with stand the physiological forces) is surgical intervention, there is considerable debate regarding optimum methods of fixation like plating (anterior, superior or combined), infix, external fixation and C-clamp.<sup>(11-15)</sup> Vaidya et al compared external fixator, infix with internal fixation. They concluded in their biomechanical study that though infix is stiffer than ext fixator, both are weaker than internal fixation.<sup>(14)</sup> When plates are used- 3.5 mostly, sometimes 4.5-mm pelvic reconstruction or contoured 3.5 dynamic compression plates are used. We operated all the patients with APC II and APC III injuries using single plating of pubic diastasis with posterior sacroiliac percutaneous 6.5 partially threaded cancellous screws for vertical instability. The opinion for single vs double plate fixation remains divided among surgeons worldwide. Some argue that in the stable open-book pelvic disruption where the posterior pelvic integrity is maintained, only 1 plate is necessary.<sup>(11,16,17)</sup> Even in pelvic injuries with posterior involvement, some authors believe single anterior plate fixation is adequate. Webb et al<sup>(14)</sup> conducted a study of 14 patients with pubic symphysis diastasis, of which 9 had posterior disruption. All were treated with a single 2-hole plate. There was no fixation failures.<sup>(17)</sup> Similarly Matta et al in their larger study using single plate for pubic symphysis stabilization found low rate of fixation failure.<sup>(18)</sup> Kapandji has proposed in APC II injuries that a small amount of nutation (nodding) movements occurring at the sacroiliac gets transmitted anteriorly to the pubic symphysis. However MacAvoy et al in their cadaveric biomechanical study on pelvic stability in the single-limb stance found no difference in vertical shear displacement at the pubic symphysis on quasistatic loading conditions between specimens fixed with single plate vs 2 plates.<sup>(20)</sup> However fatigue failure over repetitive loading, was not studied in the same study. In another study Tile et al had concluded single anterior plating to be sufficient for fixation in APC II injuries.<sup>(21)</sup> Grimshaw et al compared locked and traditional non locking plate fixation in cadavers concluded that both provided similar stability.<sup>(22)</sup> Sagi and co-authors advocate that a single multi-hole symphyseal plate instead of 2 hole plate should be used irrespective of posterior injury requiring stabilization.<sup>(23)</sup>

The other group (promoters of double plate) argues the fixation becomes very rigid and does not allow the micro motion that physiologically occurs at the pubic symphysis,<sup>(24-26)</sup> Lange et al found that double plate fixation provides most stable fixation if soft tissues are handled meticulously to minimize the blood loss.<sup>(25)</sup> Double orthogonal plate fixation definitely has advantages in osteoporotic bones, where posterior

fixation is difficult due to any reason and in severely unstable fractures with vertical shear.<sup>(26)</sup> Our sample size was small but we did not encounter any failure. We believe that single plating provides adequate stability however a larger comparative study with statistical analysis needs to be done.

Females in the child bearing age should undergo implant removal once the union has occurred. In our study, One female (age-32yrs) with APC II injury had underwent implant removal at 16 months. One more patient who had developed infection had implant removal post 9 months of surgery.

Urethral injury was an associated injury in 1 of our patient (7%) but literature suggests almost 10% in pelvic fractures. When the mode of injury is crushing of the pelvis, even bladder rupture may be there making it up to 15-20% along with non-urolological injury.<sup>(27)</sup> The membranous urethra is involved and males are more susceptible than females owing to shorter urethra in females. Bladder/ urethral injuries can also occur as iatrogenic complications that occur during operative fixation of the symphyseal diastasis.<sup>(2)</sup>

APC injuries are sometimes associated with avulsion of the medial portion of the rectus abdominis, which could give rise to ventral hernias.<sup>(28)</sup> Even direct inguinal hernias have been reported after disruption of the posterior wall of the inguinal canal.<sup>(28)</sup> With ORIF of fracture and repair of the associated soft-tissue injuries these can be prevented.

## Conclusion

To conclude, we believe single anterior symphyseal plating alone in APC II and additional sacroiliac screw fixation in type III APC injuries provide adequate stabilization. Dual plating may give marginal benefit and may be indicated in osteoporotic bones or when posterior ring fixation is technically not feasible. The radiological outcome is directly correlated with clinical functional outcome.

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