Urinary tract injury associated with pelvic fractures

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INTRODUCTION: Pelvic trauma associated with urinary tract injury is a severe trauma, mostly caused by traffic accidents and falls from heights. These injuries require urgent treatment and close teamwork between urologic and orthopaedic surgeons.

MATERIAL AND METHODS: In this retrospective study there were analyzed patients with pelvic trauma and extraperitoneal injury of urinary tract, treated surgically at Clinic for Orthopaedic Surgery and Traumatology and Urology Clinic in Clinical Center Niš. Surgical intervention in these patients had been realized as the synchronized work of both orthopaedic and urologic surgeons. The pelvis was treated by external and internal fixation. Mitkovic type external fixator was used for pelvic external fixation. Plating was used for pelvic internal fixation. Pelvic fractures were classified using Tile’s classification system. The final functional results had been scored using Majeed score system.

RESULTS: There were 42 patients with the injury of pelvic ring, treated at Clinic for Orthopaedic Surgery and Traumatology and at Urology Clinic, Clinical Center Niš, in the period of 01.01.2011. to 31.12.2013, 30 males and 12 females, with average age of 53.69 (19-84) years old. In 80% of cases pelvic fractures were caused by high energy trauma in traffic accidents. According to Tile’s classification, 9 patients (21,42%) had pelvic fracture type A, 23 patients (54,46%) had pelvic fracture type B and 10 patients (23,80%) had pelvic fracture type C. Urinary tract injury was diagnosed in 9 patients (21,42%): 5 patients (11,9%) with bladder injury, 3 patients (7,14%) with posterior urethra injury and 1 patient (2,38%) with both bladder and posterior urethra injury.

CONCLUSION: Urgent repair of extraperitoneal urinary tract injury by urologic surgeons and synchronized pelvic reduction and fixation using external or internal fixation by orthopaedic surgeon, in the same surgical procedure, is the standard method for treatment of this severe injury.

Key words: Urinary tract, Injury, Pelvic Fractures

INTRODUCTION

Generally, pelvic fractures are severe injuries that can be separated or associated with injuries of other organs and organ systems. Pelvic trauma is often present in polytrauma. Main causes of these injuries are high energy trauma in traffic accidents or falls from height. Pelvic fractured patients can be haemodinamically stable or unstable. Pelvic fractures can be stable or unstable. Biomechanical instability may provoke hemodynamical instability in the acute phase because disrupted pelvic ring leads to damage to the pelvic organs and many pelvic vessels. The close anatomical relationship between the skeletal and connective systems of the pelvis, neurological, vascular structures and pelvic organs are predisposing factors for structural and functional damage of urogenital system. The bladder and urethra are located in close proximity to the pelvic bones and these structures are susceptible to injuries when the pelvic ring is disrupted. Urinary tract injury associated with pelvic trauma are well known and described in literature. According to literature datas, 16% of pelvic fractures are associated with urinary tract injuries. Moreover, among 25% of patients with pelvic ring trauma have any type of urinary tract lesions that were either documented radiologically, or were found during surgery. Injury to the bladder ranges from contusion, which manifests as microscopic hematuria, to bladder rupture which usually presents with gross hematuria.

OBJECTIVE

Pelvic ring fractures are severe injuries and it is often associated with urinary tract injury. These associated injuries require close teamwork between urologic and orthopaedic surgeons. The aim of this study is to present...
our results in treatment of patients with both pelvic and urinary tract injury.

**MATERIAL & METHODS**

In this retrospective study there were analyzed patients with both pelvic trauma and extraperitoneal urinary tract injury, treated surgically at Clinic for Orthopaedic Surgery and Traumatology and Urology Clinic in Clinical Center Nis. These patients were treated surgically in the same surgical procedure, by synchronized teamwork of orthopedic and urology surgeons. In one case there was the need for additional orthopaedic surgical intervention regarding to definitive stabilization of unstable pelvic ring fracture. As fixation material were used Mitkovic external fixation device (Otokon, Serbia) and plates (Synthes, USA). Regarding to pelvic trauma, X-rays (AP, Inlet, Outlet) and CT were used as diagnostic procedures. Regarding to urologic trauma, catheterization, contrast urography, cystography and CT contrast cystography were used as diagnostic procedures. Pelvic fractures were classified using Tile’s classification system (Table 1). The final functional results had been scored using Majeed scoring system.

**RESULTS**

According to Tile’s classification, 9 patients (21,42%) had pelvic fracture type A, 23 patients (54,46%) had pelvic fracture type B and 10 patients (23,80%) had pelvic fracture type C (Figure 1).

Urinary tract injury was diagnosed in 9 patients (21,42%): 5 patients (11,9%) with bladder injury, 3 patients (7,14%) with posterior urethra injury and 1 patient (2,38%) with both bladder and posterior urethra injury (Figure 2,3). In the group of 9 patients (21,42%) with urinary tract injury 7 patients (16,66%) had pelvic fracture type B (Figure 4,5) and 2 patients (4,76%) had pelvic fracture type C. All patients with both bladder and posterior urethra injury were treated surgically, together with reduction and fixation of the pelvic ring in the same surgical procedure. As the procedure of “Damage Control Orthopaedic” (DCO) in 1 case there was performed primary bladder repair and external fixation of type C fractured unstable pelvic ring. After the stabilization of vital parameters and general health status, there was performed secondary surgical procedure – removal of external fixator and definitive stabilization of anterior and

<table>
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<th>TABLE 1</th>
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<tr>
<td><strong>TILE’S CLASSIFICATION OF PELVIC DISRUPTION</strong></td>
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<tr>
<td><strong>Type A - Stable</strong></td>
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<td>A1 Fractures of the pelvis not involving the ring</td>
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<td>A2 Stable, minimally displaced fractures of the ring</td>
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<tr>
<td><strong>Type B - Rotationally unstable, vertically stable</strong></td>
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<td>B1 Open book</td>
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<td>B2 Lateral compression: ipsilateral</td>
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<td>B3 Lateral compression: contralateral (bucket-handle)</td>
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<tr>
<td><strong>Type C - Rotationally and vertically unstable</strong></td>
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<tr>
<td>C1 Rotationally and vertically unstable</td>
</tr>
<tr>
<td>C2 Bilateral</td>
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<td>C3 Associated with an acetabular fracture</td>
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**FIGURE 1.** PELVIC FRACTURES ACCORDING TO TILE’S CLASSIFICATION

**FIGURE 2.** URINARY TRACT INJURY ASSOCIATED WITH PELVIC FRACTURES

**FIGURE 3.** DISTRIBUTION OF THE URINARY TRACT INJURY ASSOCIATED WITH PELVIC FRACTURES.
posterior pelvic ring complex by internal fixation (Figure 6). According to Majeed score final functional result was excellent in 5 and good in 4 cases. Regardless to these functional results there was the need for further urological treatment of urinary incontinence in 1 case, 1 patient had erectile dysfunction and 1 patient had dyspareunia after bladder repair and symphyseal plate fixation.

DISCUSSION

Pelvic trauma associated with urinary tract injury is presented as very severe injury status. The treatment of these injuries is often separate and specific, especially in unstable pelvic fractures associated with urinary tract injury. Health consequences and permanent disability are possible to occur regardless to the adequate treatment of these injuries. Regarding to orthopaedic surgeons object, it is mandatory to obtain pelvic ring stabilization, necessary to reduce possible consequences such as chronic back pain, impossibility of standing and sitting for long time and inequality of lower limbs. Urologic intervention is necessary to obtain normal urinary tract function. Serious latter sexual dysfunction is found in significant number of patients. All these conditions can lead to permanent disability and very severe and continuous psychical problems. Pelvic fractures induced by high energy trauma can be stable, partial unstable or unstable. Pelvic fractures can be present as separated injury, in polytrauma or injury associated with other organs and organ systems injury. Urinary tract injury occurrence is proportional to severity of pelvic ring fracture. Bladder and urethra injury is more possible to occur together with pubic symphysis injury or pubic bone fractures, because of their closed anatomical position. Among patients with rupture of the symphysis almost 42% had have urinary tract injury. Most of associated injuries occur with a full bladder. Injury of the urogenital organs during pelvic trauma has an important negative prognostic value in terms of morbidity and quality of life. Early diagnosis, early surgical intervention, orthopaedic and urologic surgeons teamwork are considered as the standard treatment protocol for these injuries. Diagnosis of pelvic ring trauma requires physical examination, X-rays (AP, Inlet, Outlet) and often CT. Diagnosis of urinary tract trauma require physical examination and urethral catheterisation. The major sign of urinary injury is macroscopic hematuria which is present in 82-95% of patients, while 5-15% of patients may have only microscopic hematuria. Haematuria presence requires adequate diagnostic...
procedures. For early diagnosis the retrograde cystography should be performed after urethral or suprapubic catheterization. Because most of cases require CT scans to evaluate pelvic or intraabdominal injury, CT cystogram might be recommended in patients with suspected trauma of the urinary tract. When urethral injury is suspected, contrast urethrogram is performed. According to literature, approximately 90% of patients with bladder rupture will have an associated pelvic fracture, and management of these patients requires close cooperation between the urologic and orthopaedic teams. Urologic trauma is more common in men, because of the longer male urethra. Eighty-five percent of bladder rupture are extraperitoneal. Intrapitoneal ruptures are more rare. Intrapitoneal injuries are treated surgically with direct suture repair. Extraperitoneal ruptures are treated nonsurgically, regarding to literature database. In our cases, all bladder injuries were extraperitoneal, treated surgically with same surgical procedure, teamwork with external fixation or internal osseousynthesis of the anterior pelvic ring and primary repairs of bladder or urethral disruptions or both. Bladder repair decrease complications by approximately 50%. Reasons for this treatment type can be found in the fact that orthopaedic and urologic surgeons use the same surgical approach (Pfannenstiel approach) for plating of symphysis pubis and bladder repair. Bladder repair will stop urinary leakage from the injured bladder onto the orthopaedic implant (plate, screws). Patients with extraperitoneal ruptures treated conservatively have higher rate of acute complications (12-26%), and these to be more serious (fistula, failure to heal, sepsis). Despite adequate urinary tract injury treatment, many patients showed different urinary complications. These complications were minor in 32.9% of patients and major in 8.1% of all pelvic fractures. Erectile dysfunction along with urinary incontinence is a common consequence of the pelvic fracture, especially combined with damage of posterior urethra. Reduction and stable fixation of pelvic ring are necessary to obtain as good anatomical and functional results as possible. Inadequate treatment of pelvis fractures leads to permanent disability. Pelvic ring fixation in haemodynamically unstable patients with pelvic fracture type B, C is performed by external fixation. External fixation can be used as definitive treatment procedure in haemodinamically stable patients with pelvic fracture type B, if the pelvic ring reduction is achieved. Otherwise, literature data suggestions for pelvic fractures type B with disruption of the symphysis pubis more than 2,5 cm is pubic symphysis pubis reduction and fixation by plate in the same surgical procedure with repair of bladder and urethra. External fixation can be used as temporary treatment method in type C

FIGURE 5. PUBIC SYMPHYSIS DISRUPTION CAUSED BY HIGH ENERGY TRAUMA IN CAR ACCIDENT INJURY (TYPE B- OPEN BOOK) (A); BLADDER RUPTURE WITH THE CONTRAST EXTRAVASATION (B); X-RAY AFTER REDUCTION AND INTERNAL FIXATION (PLATING) OF PUBIC SYMPHYSIS. BLADDER REPAIR HAD BEEN PERFORM IN THE SAME SURGICAL PROCEDURE (C).
pelvic fractures. The conversion of external to internal fixation, after general health status stabilization and after final urologic procedures, enables patients to be active. In our cases, Mitkoviæ type external fixator had been used for pelvic ring fixation (Figure 7)\textsuperscript{18}. This device is high adaptable and adequate for temporary or definitive pelvic fixation. There should be noted that external fixation can be used as definitive treatment method in unstable type C pelvic fractures and skeletal traction is mandatory\textsuperscript{19}. Pelvic fractures type C are rotatory and vertically unstable and adequate vertical stability cannot be obtained using external fixation, because of posterior pelvic complex injury, and additional skeletal traction is required. Disadvantages of external fixation are that they do not provide posterior stability and can potentially increase pelvic de-

formity and increase posterior displacement in a pelvis with a vertically unstable fracture configuration (Type C)\textsuperscript{1,20}. Literature data suggests open reduction and stable internal fixation of both anterior and posterior pelvic complex in haemodinamically stable patients to enable early activation and to achieve good final functional and anatomical results\textsuperscript{21}.

CONCLUSION

Pelvic trauma associated with injury of urinary tract is very severe condition requiring urgent treatment and teamwork of orthopaedic and urologic surgeons, with the same objective of their work. Primary reconstruction of bladder and urethra, catheterisation and drainage, performed by urologic surgeons, and reduction and stable
external or internal pelvic ring fixation, performed by orthopaedic surgeons, are treatment procedures that give a chance for good anatomical and functional results.

SUMMARY

POVREDE UROTRAKTA UDRUŽENE SA PRELOMIMA KARLICE

Uvod: Povrede karlice i urotrakta su teške povrede, nastaju najčešće u saobraćajnim udesima i pri padu sa višine. Ovakve povrede zahtevaju hitan tretman i blisku saradnju urologa i ortopeda. Materijal i metode: Retrospektivna studija pacijenata sa povredama karlice i ekstraperitonealne povrede urinarnog trakta, koji su lečeni hirurški na ortopedsko-traumatološkoj i urološkoj klinici KC Niš. Pacijenti su lečeni operativno, timski u sklopu iste hirurške procedure od strane ortopeda i urologa. Karlica je fiksirana spoljašnjom ili unutrašnjom fiksacijom. Za spoljašnju fiksaciju je korišćen spoljašnji fiksator po Mitkoviću, a za unutrašnju fiksaciju su korišćene rekonstrukтивне ploče sa zavrtnjama. Tyle-ova klasifikacija je korišćena za klasifikaciju povreda karlice, a za ocenu krajnjih funkcionalnih rezultata je korišćen funkcionalni skor po Majeed-u. Rezultati: U periodu od 01.01.2011 do 31.12.2013 na klinici za ortopedsku hirurgiju i traumatologiju i na urološkoj klinici KC Niš je lečeno 42 pacijenta sa povredama karliknog prstena, 30 muškaraca i 12 žena, prosečne starosti 53,69 godina (od 19- 84 godina). U 80%, povrede karlice su nastale kao direktna posledica saobraćajnog traumatizma. Prema klasifikaciji Tyle-a, 9 (21,42%) pacijenta je zadobilo povredu karlice tipa A, 23(54,46%) povredu tipa B i 10 (23,80%) pacijenta povredu tipa C. Povrede urotrakta su dijagnostikovane kod 9 (21,42%) pacijenata - 5(11,9%) sa povredom mokraće bešike, 3 (7,14%) sa povredom zadnje uretre i 1 (2,38%) sa povredom mokraće bešike i zadnje uretre. Zaključak: Hitna rekonstrukcija ekstraperitonealne povrede urotrakta od strane urologa, repozicija i fiksacija karalice spoljašnjom ili unutrašnjom fiksacijom od strane ortopeda u sklopu iste hirurške procedure predstavlja standard u lečenju ovih povreda.

Ključne reči: urinarni trakt, povrede, prelomi karlice

REFERENCES:


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