CASE REPORT

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Pelvic Traumas and Hybrid Emergency Medicine System: Literature Review Based on Two Cases

Pelvik Travmalar ve Hibrit Acil Tıp Sistemi: İki Olguya Dayalı Literatür Taraması

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ABSTRACT

Objective: *Bleeding, the most common life-threatening complication of pelvic trauma occurs due to injuries of pelvic arterial and venous structures and bone fractures. The outcomes of patients can be improved by a timely performed angioembolisation (AE). Hybrid Emergency Service System (HERS) has been recently introduced a novel approach which provides trauma resuscitation room equipped with computerized tomography, fluoroscopy, and an operating room, thus effects the outcomes of trauma patients.*

Cases: *We presented two pelvic traumas and in both cases with the most common life-threatening complication was bleeding. In both cases, whole-body computed tomography (WBCT), endovascular procedures (Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA), transcatheter arterial embolization (TAE)), and injury control surgery can be simultaneously performed without the need to transport a patient to an operating room which is called HERS resuscitation. Both patients were discharged and remained free of any medical problem at long-term (12 months) follow-up.*

Conclusion: *Considering the recently introduced HERS system in patient management and integrating it into emergency services will be extremely useful in the management of trauma and trauma-induced bleeding.*

ÖZET

Amaç: *Pelvik travmanın en sık görülen, yaşamı tehdit eden komplikasyonu olan kanama, pelvik arteriyel ve venöz yapıların yaralanması ve kemik kırıklarına bağlı olarak ortaya çıkar. Zamanında yapılan anjiyoembolizasyon (AE) ile hastaların sonuçları iyileştirilebilir. Hibrit Acil Servis Sistemi (HERS), bilgisayarlı tomografi, floroskopi ve ameliyathane ile donatılmış travma resüsitasyon odasını sağlayan ve böylece travma hastalarının sonuçlarını etkileyen yeni bir yaklaşımla yakın zamanda tanıtılmıştır.*

Olgular: *Pelvik travması olan iki hasta sunduk ve her iki olguda da en sık görülen yaşamı tehdit eden komplikasyon kanamaydı. Her iki durumda da tüm vücut bilgisayarlı tomografi (BT) taraması, endovasküler işlemler (Aortun Resüsitatif Endovasküler Balon Oklüzyonu (REBOA), Transkateter Arteriyel Embolizasyon (TAE)) ve yaralanma sonrası kontrol cerrahi, hastanın ameliyathaneye nakledilmesine gerek kalmadan, HERS resüsitasyonu adı verilen sistemde eş zamanlı olarak gerçekleştirilebilmektedir. Her iki hasta da sağlıklı olarak taburcu edildi ve* ***uzun dönem (12 ay) takiplerinde herhangi bir tıbbi sorun yaşanmadı.***

Sonuç: *Son dönemde kullanıma sunulan HERS sisteminin hasta yönetiminde dikkate alınması ve acil servislere entegre edilmesi travma ve travmaya bağlı kanamaların yönetiminde son derece faydalı olacaktır.*

Keywords:
Pelvic trauma
Bleeding
HERS

Anahtar Kelimeler:
Pelvik travma
Kanama
HERS

INTRODUCTION

Bleeding, the most common life-threatening complication of pelvic trauma occurs due to injuries of pelvic arterial and venous structures and bone fractures. Although it most commonly occurs secondary to venous injury, arterial bleeding is associated with a higher mortality rate (1). Current treatment approaches for pelvic bleeding include pelvic binder, external fixator, Pelvic C-Clamp, Pelvic Angiography, and Pelvic packing techniques (2). Although pelvic stabilization is sufficient to treat a considerable number of venous injuries, arterial bleeding causing hemodynamic instability primarily requires intervention via transcatheter arterial embolization (TAE) (3).

The outcomes of patients with bleeding caused by pelvic fractures can be improved by a timely performed angioembolisation (AE). In addition, a correlation has been found between delayed AE and increased mortality (4). One of the approaches that have recently been put forward in this regard is the Hybrid Emergency Service System (HERS) which is used to describe a novel trauma resuscitation room equipped with computerized tomography, fluoroscopy, and an operating room. In

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this way, HERS resuscitation and WBCT, endovascular procedures (Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA), transcatheter arterial embolization (TAE)), and injury control surgery can be simultaneously performed without the need to transport a patient to an operating room (5). In this case series, we aimed to stress the importance of HERS for the management of pelvic trauma-associated bleeding.

CASE 1

A 59-year-old man was brought to our emergency department (ED) by the ambulance service with a provisional diagnosis of blunt abdominal and pelvic trauma within approximately 40 minutes after a motor vehicle accident. On admission, the patient has a poor overall status, but he was conscious and oriented and showed full cooperation. He had a Glasgow Coma Scale (GCS) score of 15 (E4V5M6), and his vital signs were as follows: Blood pressure (BP): 105/68 mmHg, heart rate (HR): 107bpm, respiratory rate (RR): 22/min, SaO2: 94%. His physical examination (PE) was otherwise normal except diffuse abdominal and both pubic arms tenderness. WBCT was ordered, which revealed liver laceration as well as sacral and bilateral pubic arm fractures (Figure 1). His laboratory tests showed a hemoglobin level of 14.7 g/dL and a WBC of 19.1 mm3. Blood gas analysis showed the following: pH 7.304, BE -5.8 mmoI/L, lactate level 5.2 mmoI/L. The patient had a liver injury (AAST II. Stage hematoma), multiple non-displaced rib fractures, pelvic lateral compression fracture, and urethral injury. He had an Injury Severity Score (ISS) of 30, Revised Trauma Score (RTS) of 7.8408 and, according to the Trauma Injury Severity Score (TRISS), a survival likelihood of 83.77%. The shock index was calculated at 1.0. Erythrocyte suspension (ES) replacement was planned. The patient's hemodynamic instability was attributed to a vascular injury resulting from a pelvic injury, as evidenced by a significant and uncontrollable decrease in hemoglobin levels. Since pelvic computed tomography (CT) angiography showed active contrast material extravasation in the left pelvic region, the patient was urgently taken to Digital Subtraction Angiography (DSA).

The pelvic angiograms showed no active extravasation. However, there was a filling pattern that may have been due to a vessel stump in the mid-portion of the posterior trunk of the left internal iliac artery, or to a pseudoaneurysm of the internal pudendal artery. Considering the possibility of transient blockage of extravasation by the compressive effect of a large hematoma, embolization of the described vessel stump was planned. Urgent TAE was performed and hemostasis was achieved. No postoperative complication occurred, and hemoglobin drop was effectively stopped. The patient gradually got hemodynamic stability during his ED follow-up and treatment process. A consultation was obtained from the department of orthopedics, which recommended conservative care. A consultation was also obtained from the department of urology due to urethral injury detected by a retrograde cystography, for which a cystofix was placed (Figure 2). The patient was then transferred to the intensive care unit (ICU). After close follow-up by various surgical branches for three days, he was transferred to the regular ward. He experienced no other problem during his follow-up and was discharged with a cystofix 5 days later. He was free of any medical problem at long-term (12 months) follow-up.

Figure 1: Left superior pubic ramus comminuted fracture seen in coronal plane on abdominal CT

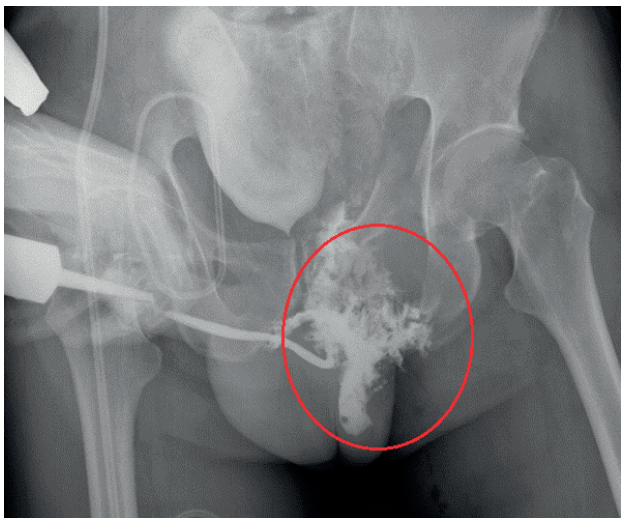

Figure 2: Urethral injury image on retrograde cystography

CASE 2

A 53-year-old woman was brought to our ED by the ambulance service with the provisional diagnoses of pelvic and head trauma 30 minutes after an out-of-vehicle traffic accident. On admission, she has altered mental status (GCS score of 13, E3V4M6) with restricted cooperation. Her vital signs were as follows: BP: 90/67 mmHg, HR: 115 bpm, RR: 24/min, SaO2: 92%. PE revealed ecchymosis on neck and head and abdominal tenderness. Targeted bedside ultrasonography revealed no intraabdominal bleeding. She had a WBC of 19.16 mm3 and a Hb level of 13.5 g/dL. A head CT performed to check head trauma showed a linear non-depressed fracture in the occipital region, cerebral contusion, and minimal subarachnoid bleeding in the frontal region. A plain radiogram showed fractures in the sacrum and both pubic arms (Figure 3). The patient had an ISS of 32, a RTS of 7.108, and a shock index of 1.5. It was considered that hemodynamic instability may have been due to pelvic vascular injury secondary trauma. Since a pelvic CT angiogram showed no contrast extravasation, a DSA was performed, which showed a

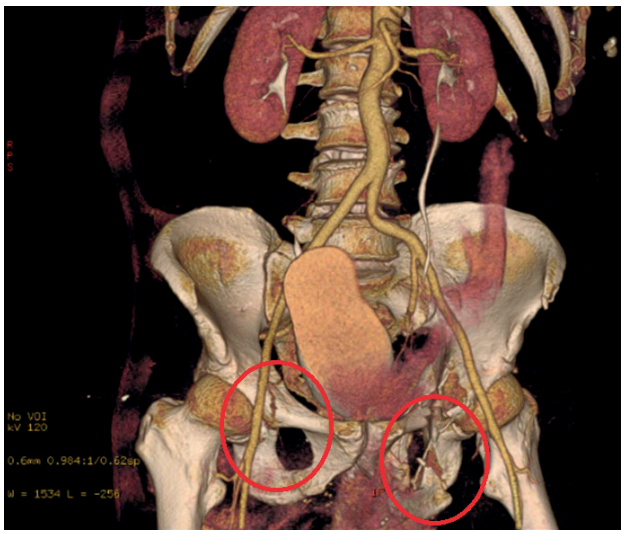

Figure 3: Bilateral pubic arm fracture CT Angiography 3D view (contrast material accumulated in the bladder due to concomitant urethral injury)

bleeding focus in the distal part of the pudendal branch of the left internal iliac artery. Urgent TAE procedure was performed and the bleeding focus was blocked with the help of a coil. The subsequent angiograms showed that the pathological staining disappeared. The patient gradually got hemodynamic stability during her ED follow-up and treatment. A consultation was obtained from the department of orthopedics, and the patient was admitted to the ICU. The patient was free of any complications during her follow-up and was discharged on the fourth day. She also remained free of any medical problem at long-term (12 months) follow-up (Figure 4).

DISCUSSION

Since fractures involving the pelvis, a highly vascular region, are associated with excessive mortality, prompt diagnosis and rapid management of a bleeding source in that region are of critical importance in terms of survival

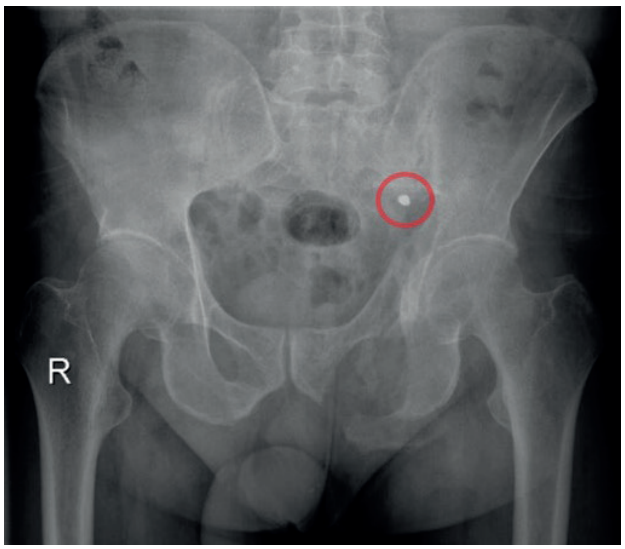

Figure 4: Embolizing coil in the black circle that can be seen on the radiograph of the patient who came to the outpatient clinic.

(1,6). As demonstrated by our cases, iliolumbar, sacral, superior-inferior gluteal, obturator, internal pudendal, or inferior epigastric artery can be injured, depending on the fracture site (7).

Pelvic vascular injuries due to fractures are diagnosed by demonstrating contrast material extravasation in pelvic CT angiography; however, the absence of contrast material extravasation does not necessarily imply the absence of bleeding because contrast material extravasation is not observed in 25% of patients, and it is also the most effective technique for controlling ongoing arterial bleeding (4,8). However, DSA is indicated to rule out potential sources of intermittent bleeding in hypotensive patients who show no sign of active extravasation but have a large pelvic hematoma, and in patients having signs of arterial bleeding on CT angiography (1). A timely performed AE may improve patient outcomes in bleeding secondary to pelvic fracture; hence, a relationship has been demonstrated between delayed AE and increased mortality (4). One of the approaches that have come up recently in this regard is the HERS, which was first reported in Japan in 2012 as a novel management flow protocol for patients with severe blunt trauma and named as “Hybrid Emergency Room (Hybrid ER)” since it is based on a combination of “examination “and “treatment”. This system was updated by a study dated 2018 that enrolled 336 patients with blunt trauma, and subsequently named Hybrid Emergency Service System (9). This term is used to describe a novel type of trauma resuscitation room equipped with computerized tomography, fluoroscopy, and an operating room. HERS resuscitation enables physicians to simultaneously perform WBCT, endovascular procedures (REBOA/TAE), and injury control surgery without needing an operating room (5). Although the introduction of multidetector CT has largely shortened the time to perform a CT scan, prolongation of the time to perform urgent surgery due to patient transfer to a room equipped with CT in the traditional technique continues to be unacceptable for patients with hemodynamic instability (9); hence, HERS resuscitation has gradually gained importance. In HERS, airway and respiratory tract abnormalities are evaluated first; a CT examination can be performed within 10 minutes after ED admission under continuous monitoring, which allows rapid recognition of life-threatening injuries even in patients having shock.

If a patient’s vital signs remain extremely unstable despite a rapidly performed CT scan, more aggressive resuscitation including resuscitative thoracotomy and REBOA can be pursued (9).

Although life-threatening hemorrhagic events are traditionally managed surgically, non-surgical management of trauma by interventional radiology (IR) procedures in trauma care systems equipped with the latest technology have become an important focus of interest even for the care of hemodynamically unstable patients; however, the unavailability of interventional radiologists (IRs) at times negatively affects the timing of the treatment (10). In HERS, on the other hand, a well-trained multidisciplinary team consisting of highly specialized professionals such as surgeons, emergency medicine specialists, IRs, and technicians/nurses always

stays ready to intervene in accordance with the concept of trauma resuscitation in a single room; patients with a lower chance of survival according to TRISS can survive in HERS (4). This particularly improves the AE timing of patients with pelvic fracture and fatal bleeding, thereby allowing early bleeding control and improved survival (11).

As can be seen in the two cases that we intervened with the conventional method in our hospital, critical patients were first transferred to the tomography room and then to the operating room or DSA. In addition to the extra burden of gathering the team for DSA for emergency medicine specialists, patient intervention is very challenging for intensive emergency services with a limited number of personnel, since serious patients must be accompanied by a professional healthcare worker during transport. One of the obstacles to the spread of HERS is sufficient capital investments not only for the installation of the CT angiography machine but also for the rebuilding of the ED and maintenance of the equipment. Although this system is thought to be effective in the management of patients with life-threatening hemorrhagic trauma, it is still unclear if these investments would worth their cost (12). Further studies are needed to aid healthcare decision-makers to decide if it is worth investing in equipment to improve the survival of target populations.

Conflict of Interest: No conflict of interest was declared by the authors.
Ethics: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given his consent for his images, and other clinical information to be reported in the journal. The patient understands that name and initials will not be published and due efforts will be made to conceal the identity, but anonymity cannot be guaranteed.
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