



The Immediate Impact of Pelvic Arterial Embolization on Trauma Patients with Unstable Pelvic Fracture: systemic review and meta- analysis

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INTRODUCTION

- Pelvic fractures caused by blunt trauma can lead to significant morbidity and mortality.
- Mortality rate ranges from 5 to 60% with hemorrhage being the most common cause of death within 24 hours.
- Multidisciplinary approach is needed for the complex management of these patients.
- Rapid hemorrhage detection and control can improve survival outcomes.
- TAE (transcatheter arterial embolization) is an effective way to manage arterial bleeding, with a success rate of over 85%.
- Combination of angiography and arterial vessel embolization has proven to be an excellent management method.
- Prior to TAE, patients are adequately resuscitated with blood product transfusion and temporary mechanical stabilization.
- There is a paucity of research on the effectiveness of TAE in stopping hemorrhage in unstable pelvic fractures.
- The purpose of this review is to examine the effects of angioembolization on patients with unstable pelvic fractures.
- The hypothesis is that TAE can stop hemorrhage with increased transfusion rates prior to angioembolization, resulting in a higher survival outcome.

METHODOLOGY

- The search was conducted on PubMed, MEDLINE, EMBASE, CINAHL, and bibliographic references and bibliographic references, focusing on studies published from 2000-2022, using specific keywords.
- Inclusion criteria: English-language original studies on pelvic fractures, unstable pelvic fractures, angioembolization, angiography, embolization, blood transfusion, and various study designs.
- Exclusion criteria: studies without full text, animal or cadaveric studies, case studies or case series, editorials, and reviews or surveys.
- Study characteristics extracted included the first author's last name, study year, average age, Injury Severity Score, number of patients who underwent angiography and embolization, number of patients with unstable pelvic fracture, mortality post-embolization, average delay to angiography, transfusion rates pre- and post-angiography, and blood pressure pre- and post-angiography.

RESULTS

After removal of duplicates and assessment for eligibility, there were 33 studies included in the analysis. Publication dates ranged from 2000-2022. Twenty-nine studies were retrospective cohort studies, and two studies were prospective observational studies, and one study was a randomized controlled trial. Thirty-three examined the mortality rate among patients undergoing angioembolization, 12 examined the rate of change in transfusion after TAE, and 8 systolic blood pressure [pre-versus-post- TAE]. All articles were available in English.

The mean age was 44.1 ± 5.6 and the mean ISS was 33.6 ± 6.5. There were 3,492 patients who underwent angiography, 2,154 patients who underwent embolization, and 407 underwent angioembolization secondary to uncontrolled hemorrhage

Table 1: Mortality rate among patients undergoing embolization secondary to unstable pelvic fracture.

Author	Average Age	ISS	N underwent angiography	N underwent embolization	N pts with unstable pelvis fx	Mortality among pts post embolization n (%)	Average delay to angiography (min)
Fierro et al.	50	33	28	20	28	8/20 (40%)	150
Filiberto et al.	45	22	74	50	45	13/50 (26%)	180
Devaney et al.	49	36	36	25	36	5/36 (14%)	233
Lai CY et al.	46	26	545	129	129	18/129 (14%)	64
Matsumoto S et al.	53	34	1131	690	-	372/690 (54%)	-
Chou et al.	45	26	84	84	84	14/84 (17%)	77
Otsuka et al.	46	49	16	16	16	4/16 (25%)	54
Hymel et al.	53.5	26.4	67	26	67	5/26 (19%)	-
Tesoriero et al.	45	29	344	212	212	40/212 (19%)	286
Ruatt et al.	42	37	28	26	28	11/26 (42%)	-
Tanzaki et al.	30	42	68	68	68	12/68 (18%)	110
El Haj et al.	37	36	61	38	61	10/38 (26%)	-
Thorson et al.	54	35	134	117	117	24/117 (24%)	-
Tai et al.	45	42	13	13	13	9/13 (69%)	140
Cherry et al.	51	37	12	12	12	6/12 (50%)	-
Costantini et al.	46	31	31	18	31	6/18 (33%)	-
Morozumi et al.	36	32	29	29	29	3/29 (10%)	66
Jeske et al.	48	30.6	42	42	42	14/42 (33%)	163
Jeroukhimov et al.	41	-	29	20	29	1/20 (5%)	210
Fang et al.	36	29	174	140	174	16/140 (19%)	584
Osborn et al.	40	46	20	13	20	6/20 (30%)	276
Totterman et al.	40	41	46	31	46	5/31 (16%)	540
Gourlay et al.	40	28	41	41	41	21/41 (51%)	420
Sadri et al.	49	32	7	5	7	1/5 (20%)	432
Fangio et al.	37	39	32	25	32	10/32 (31%)	283
Sarin et al.	45	37	37	37	37	13/37 (35%)	-
Shapiro et al.	44	31	31	20	31	2/20 (10%)	-
Kimbrell et al.	42	24	92	55	92	10/55 (18%)	-
Hagiwara et al.	46	34	81	61	81	13/61 (21%)	81.4
Cook et al.	38	34	23	18	23	10/23 (43%)	222
Velmahos et al.	43	25	73	30	73	10/30 (33%)	-
Agilini et al.	49.8	38	35	15	35	7/15 (47%)	364
Maltalon et al.	41.6	-	28	28	28	13/28 (46%)	-

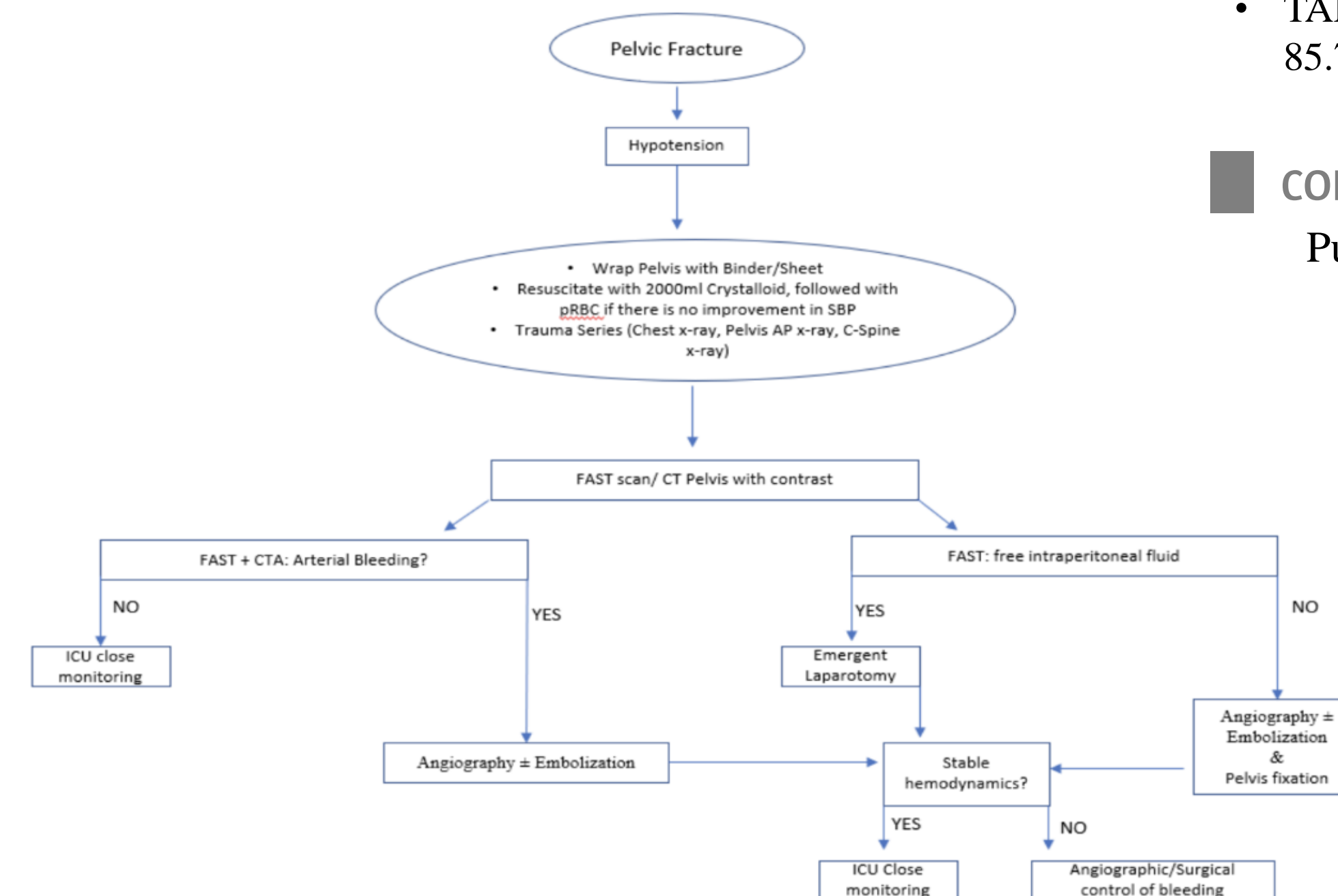
Table 2: Rate of change in blood transfusion pre vs post-angiography

Author	Age	ISS	N underwent Angiography	N underwent embolization	Transfusion (U/hr)		Mortality among pts post embolization n (%)	Average delay to angiography (min)
					Pre-Angio	Post-Angio		
Hymel et al.	53	26	67	26	0.4/h	0.1/h	5/26 (19)	-
El-Haj et al.	37	36	61	38	1/h	0.6/h	10/38 (26)	-
Jeske et al.	48	31	42	42	3.7/h	0.1/h	14/42 (33)	-
Jeroukhimov et al.	41	-	29	20	0.4/h	0.1/h	1/20 (5)	163
Fang et al.	36	29	174	140	0.85/h	0.1/h	26/140 (18.5)	210
Osborn et al.	40	46	20	13	2/h	0.4/h	6/20 (30)	584
Barsel et al.	47	25	39	19	1/h	0.17/h	-	276
Totterman et al.	40	41	46	31	1.9/h	0.3/h	5/31 (16)	-
Sadri et al.	49	32	7	5	4.5/h	0.6/h	1/5 (20)	540
Fangio et al.	37	39	32	25	2.3/h	0.1/h	10/32 (31)	283
Shapiro et al.	44	29	31	20	1.37/h	0.29/h	2/20 (10)	283
Maltalon et al.	42	-	28	28	0.7/h	0.16/h	13/28 (46)	-

Table 3: Efficacy of Pelvic angio-embolization in stopping bleeding secondary to pelvic fractures

Author	Age	ISS	N underwent Angiography	N underwent embolization	Blood Pressure (mmHg)		Mortality among pts post embolization n (%)	Average delay to angiography (min)
					Pre-Angio SBP (Std Dev)	Post-Angio SBP (Std Dev)		
Otsuka et al.	46	49	16	16	75.1 (21.9)	11.5 (27.0)	4/16 (25)	56.3
Hymel et al.	53	26	67	26	115.5(26.3)	121(24.5)	5/26 (19)	-
Osborn et al.	40	46	20	13	75.8(11.7)	87.1(21.1)	6/20 (30)	584
Gourlay et al.	40	28	41	41	96.7(32)	115.8(24.8)	21/41 (51)	420
Fangio et al.	37	39	32	25	65(12)	108(35)	10/32 (31)	283
Hagiwara et al. 2004	40	38	19	19	79.9(8.4)	120(19.3)	-	92
Hagiwara et al. 2003	45	34	81	61	59.5(20.7)	83.7(13.9)	13/61 (23)	82
Velmahos et al.	43	25	73	30	118	128	10/30 (33)	-

Figure 1: Algorithm for treating hemodynamically unstable pelvic ring fractures



DISCUSSION

- In the present study, the findings indicate that angioembolization is effective in controlling hemorrhage by improving the systolic blood pressure and reducing mortality and rate of transfusion in hemodynamically unstable patients with unstable pelvis fracture, however continued resuscitation efforts must continue as severe bleeding persist post- TAE.
- Time to the OR was an important factor in determining mortality rates. The average time to the OR was roughly within 4 hours of admission and this correlates to those results of Chou et al., that performing TAE within 3 hours after admission leads to better outcome.
- Resuscitation prior to TAE decreases the rate of bleeding post-TAE. Results from Miller et al., suggests that patients with resuscitation first leads to 73% positive angiography rate. Despite this, we still had persistent bleeding post- TAE. This can be attributed to ineffective angioembolization of veins or fractured cancellous bone surfaces.
- Tai et al. reported that even with successful embolization, patient mortality remains high and showed that angioembolization cannot always stop the hemorrhage arising from pelvic fractures.
- In all the studies, prior to TAE, the rate of transfusion was higher compared to post-TAE. This finding correlates to Karadimas et al where increased initiation transfusion of >0.5 unit/hour in hemodynamic patients have been shown to be predictors for TAE.
- TAE can improved SBP leading to an overall survival rate of 85.7%.

CONTACT

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