To pack or plug: American Association for the Surgery of Trauma multicenter evaluation of hemorrhage control interventions in pelvic fracture management

Melike N. Harfouche, MD, Leslie Sult, MS, BSN, RN, Jason D. Sciarretta, MD, Samuel R. Todd, MD, Christopher F. O'Neil, MD, Jonathan P. Meizoso, MD, Allison McNickle, MD, Douglas Fraser, MD, Millicent Croman, MD, *and* **Joseph J. Dubose, MD**, *Baltimore, Maryland*

INTRODUCTION: Mortality from pelvic ring fractures (PRFs) complicated by hemorrhagic shock remains high, and there are limited high-quality data to guide care. We compared two primary hemorrhage control interventions: pelvic angiography +/− embolization (PAE) and preperitoneal pelvic packing (PPP), hypothesizing similar odds of death.

METHODS: A prospective, multicenter, observational study was conducted for individuals with blunt trauma–associated PRF with a systolic blood pressure of <90 mm Hg who received ≥4 U of packed red blood cells within 24 hours and/or used a hemorrhage control intervention (2022–2024). Bivariate comparisons, multivariable regression controlling for several clinical factors, and inverse probability treatment weighting analysis were performed. Primary outcomes were 3- and 6-hour mortality.

RESULTS: Of 948 patients, 524 underwent either PPP (n = 68, 13.0%), PAE (n = 390, 74.4%), or both (n = 66, 12.6%) and comprise the study cohort. Compared with PAE, PPP patients had higher Injury Severity Scores (41 vs. 34, $p < 0.001$) and worse physiology (lowest systolic blood pressure, 62 vs. 74 mm Hg; lactate, 6.4 vs. 4.3; $p < 0.001$) and more frequently underwent laparotomy (67.6% vs. 23.6%, $p < 0.001$). In-hospital (47.1% vs. 18.5%, $p < 0.001$) and 24-hour (38.2% vs. 4.1%, $p < 0.001$) mortality were higher in PPP versus PAE with more earlier deaths (27.9% vs. 0.5% within 3 hours, $p < 0.001$). Preperitoneal pelvic packing was associated with higher odds of death at 3 hours (odds ratio, 64.0; confidence interval, 8.8–465.1) and 6 hours (odds ratio, 15.1; confidence interval, 4.4–51.7) compared with PAE. Inverse probability treatment weighting analysis demonstrated 19.4% higher probability of death at 6 hours for PPP versus PAE ($p < 0.001$).

CONCLUSION: Whereas hypotensive patients with PRFs are more likely to undergo PAE, PPP is reserved for patients with more severe hemorrhagic shock, which may account for the observed higher mortality. Findings from this study suggest that PAE is an appropriate first-line therapy for most patients with bleeding pelvic fractures at trauma centers with rapid access to endovascular therapy. (*J Trauma Acute Care Surg.* 2026;00: 00–00.

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Patients with blunt traumatic pelvic ring fractures (PRFs) who experience hemorrhagic shock have mortality rates reported to be between 32% and 36%.[1,2] Sources of blood loss for PRFs include bleeding from bone edges, the pelvic presacral and paravesical venous plexus, and arterial branches of the internal iliac arteries. As with other traumatic bleeding, rapid and definitive hemorrhage control is key. The challenge for PRFs, however, is determining optimal utilization of various hemorrhage control interventions (HCIs) once patients arrive at the trauma center.

In contrast to other sources of traumatic bleeding that have well-established approaches to hemorrhage control, the management of hemorrhagic shock from pelvic fractures includes multiple interventions that are used in highly variable combinations across major trauma centers. These interventions include pelvic angiography +/− embolization (PAE), preperitoneal pelvic packing (PPP), resuscitative endovascular balloon occlusion of the aorta (REBOA), and, rarely, direct internal iliac artery ligation.[3] The most common of these interventions are PAE and PPP, which are two vastly different interventions that require different resources.[4]

The Western Trauma Association's 2016 management algorithm for hemodynamically unstable pelvic fractures recommends PAE and/or PPP but does not specify which intervention should be prioritized.[5] The authors suggest that HCIs can be combined, as needed, in a complementary fashion. The World Society of Emergency Surgery guidelines from 2017 state that PPP and PAE should be viewed as complementary procedures, without stating which should be done first.[6] The absence of clear

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From the R Adams Cowley Shock Trauma Center, University of Maryland Medical Center, Baltimore, MD (M.N.H., L.S.); Department of Surgery, Grady Memorial Hospital, Atlanta, GA (J.D.S., S.R.T.); Department of Surgery, University of Miami Ryder Trauma Center, Miami, FL (C.F.O., J.P.M.); Department of Surgery, Kirk Kerkorian School of Medicine (A.M.), University of Nevada—Las Vegas, Las Vegas, NV; Division of Trauma, MemorialCare Long Beach Medical Center, Long Beach, CA (D.F.); Department of Surgery, Harbor UCLA Medical Center, Torrance, CA (M.C.); and Department of Surgery, Dell Medical School (J.J.D.), University of Texas at Austin, Austin, TX.

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Address for correspondence: Melike N. Harfouche, MD, R Adams Cowley Shock Trauma Center, University of Maryland Medical Center, 22 S. Greene St, Baltimore, MD 21201; email: mharfouche@som.umaryland.edu.

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guidance from any major trauma society is because research in this area remains sparse and inconclusive. A recently convened panel of experts by the Coalition for National Trauma Research to identify key research priorities in trauma care identified hemorrhage control for pelvic fractures as a key research gap that necessitated further study.[7] The American Association for the Surgery of Trauma (AAST) Pelvic Fracture Study group made significant strides in our understanding of pelvic fracture management but included only a small number of patients in shock who received an HCI.[2] Another multicenter, retrospective study was also inconclusive about the optimal order and combination of interventions, likely because of small sample size.[8]

With this in mind, we developed a prospective, multicenter, observational study to answer some of these key management questions. The primary aim of this study, also known as AAST Hemorrhage control Interventions in Pelvic fractureS (AAST HIPS), was to determine the optimum timing and combination of HCIs to reduce mortality in trauma patients presenting with pelvic fractures and hemorrhagic shock. This analysis compares PAE and PPP with regard to their association with hemorrhage-related mortality, with the underlying hypothesis that the two interventions would have similar risk of death.

PATIENTS AND METHODS

This study was approved by the AAST Multicenter Trials Committee, and a waiver of consent was granted by each participating center's institutional review board. Site recruitment, training, institutional review board and Data Use Agreement approval, and data coordination were conducted by the coordinating site. Sites entered data into the Research Electronic Data Capture tool hosted at the coordinating site.[9] Data were exported into STATA/BE 17,[10] where all analyses were performed. Site recruitment occurred on a rolling basis, with data collection conducted from March 2022 to December 2024. The goal sample size was approximately 350 subjects per group to detect a mortality difference of 10%. However, the study was closed after 2.5 years because of low recruitment of subjects in the PPP group. A total of 47 sites contributed data for the study, all of which were designated Level I trauma centers. Except for two sites located in Newcastle, Australia, and Calgary, Canada, all other sites were located within the United States.

Subjects were eligible for inclusion if they had radiographic documentation of a PRF from blunt trauma and a systolic blood pressure (SBP) of ≤90 mm Hg within the first hour of arrival. In addition, eligible patients either underwent use of a pelvic HCI or underwent transfusion of ≥4 units of packed red blood cells or 2 units of whole blood within 24 hours. Included HCIs were direct internal iliac artery ligation, PAE, REBOA, or PPP. Patients who arrived in cardiac arrest, died in the emergency department, or had isolated pubic rami or acetabular fractures were excluded. Detailed clinical characteristics were obtained from chart review, including admission vital signs and laboratory tests, Injury Severity Score (ISS), Abbreviated Injury Scale scores, Glasgow Coma Scale (GCS) score, the timing and type of HCIs performed, external and internal fixation of the pelvis, laparotomy, thoracotomy, craniotomy/craniectomy, blood transfusion volumes at 6 and 24 hours in liters, complications, time and location of death, and cause of death.

All subjects who received PPP or PAE were included in this study. The primary outcomes of interest were 3-hour and 6-hour all-cause mortality, and secondary outcomes of interest were 24-hour and in-hospital all-cause mortality.

Bivariate comparisons of injury and clinical characteristics, and hospital course were made between the PPP, PAE, and PPP-PAE groups. χ^2 Tests were used for categorical variables. Continuous variables were analyzed using independent-samples *t* test or the Wilcoxon rank-sum test, as appropriate. Parametric continuous results are reported as mean ± SD, and nonparametric continuous results are reported as median (interquartile range [IQR]). A multivariable logistic regression analysis controlling for age, sex, serum lactate level, ISS, GCS score, lowest SBP, abdominal AIS score, and REBOA use was performed to evaluate the effect of PPP and PAE on 3-, 6-, and 24-hour mortality. These variables were selected based on their likelihood of influencing either the exposure (PPP or PAE) or the outcome (mortality). The magnitude of effects was estimated using the area under the receiver operating characteristics (AUROC) curve. Sensitivity analysis was performed for 3- and 6-hour mortality using the *E* value technique, which determines the minimum strength of association a confounder would need to have with both treatment and outcome to explain away the treatment effect.[11] Inverse probability treatment weighting (IPTW) for average treatment effect using the same variables included in the regression model was also performed to evaluate for 6-hour mortality for those who received PPP versus PAE. For covariates in the IPTW model, missing values were accounted for using imputation. This was done by replacing the value with 0 if missing and creating a binary variable (yes/no) for the missing variable. The model was evaluated to ensure adequate covariate balance, defined as a standardized mean difference of <0.2. Subjects receiving a combination of both therapies (PPP +PAE) were excluded from the multivariable regression and IPTW analyses. Incomplete records, defined as missing any required field, were excluded from analysis. The STrengthening the Reporting of OBservational studies in Epidemiology checklist for cohort studies is included as Supplemental Digital Content (Supplementary Data 1, http://links.lww.com/TA/F38).

RESULTS

Of 980 enrolled subjects, 948 had complete data and were included in the analysis. A total of 549 patients (58%) received at least 1 HCI; 441 (80%) received 1, 95 (17%) received 2, and 13 (2%) received 3 HCIs. From this group, 524 underwent either PPP (n = 68, 13.0%), PAE (n = 390, 74.4%), or a combination of both (n = 66, 12.6%) and comprise the study cohort. A flow diagram of the final study population is shown in Figure 1. Characteristics of each group and the entire study population are reported in Table 1. The PPP and PPP+PAE groups were more severely injured and sustained increased injury burden and physiologic derangements, as evidenced by higher ISS (41 and 42.5 vs. 34, $p < 0.001$), lower GCS (10 and 12 vs. 14, $p < 0.001$), decreased lowest SBP (62 and 70 vs. 74 mm Hg, $p < 0.001$), and higher admission serum lactate (6.4 and 6.9 vs. 4.3 mmol/L, $p < 0.001$). Subjects in the PPP and PPP+PAE groups received more median packed red blood cells (2.1 and 2.9 vs. 1.2 L,

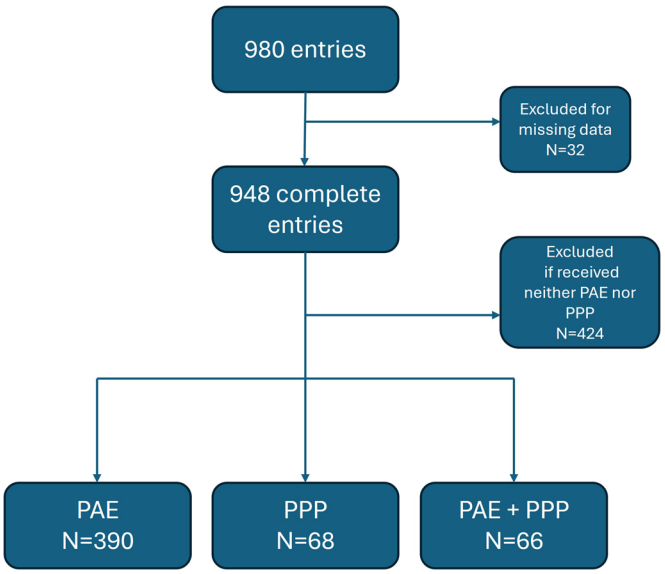

Figure 1. Flowchart of included patients.

$p < 0.001$), and the PPP group received more median whole blood transfusions (0.8 vs. 0 L, $p = 0.019$) at 6 hours from admission compared with the PAE group.

Among the 456 subjects who received pelvic angiography (with or without PPP), 285 (62.5%) had active contrast extravasation, and 391 (85.8%) underwent angioembolization. The primary indications reported for angioembolization were ongoing hemorrhage (n = 309, 79%), active extravasation (n = 67, 17%), large pelvic hematoma (n = 10, 3%), and concerning fracture pattern (n = 4, 1%). Angioembolization was deemed to have definitively controlled hemorrhage in 76% of cases, as compared with PPP where packing was deemed to have controlled hemorrhage in only 35% of cases. The median time to intervention was 76.5 minutes (IQR, 140.5 minutes) for the PPP group and 206 minutes (IQR, 176 minutes) for the PAE group ($p < 0.001$). For the PPP+PAE group, the median time to PPP was 99.5 minutes (IQR, 139 minutes), and the median time to PAE was 234 minutes (IQR, 213 minutes). Overall, 75% of subjects underwent PPP before PAE.

When evaluating center-specific practice patterns, it was evident that all centers performed PAE more commonly than PPP. The median number of PAE performed per institution across the study period was 6 (IQR, 8) compared with a median number of PPP of 1 (IQR, 3). Twenty of the 47 centers (43%) did not perform any PPP throughout the study period.

Table 2 reports the differences in additional emergent interventions and procedures performed between the PPP and PAE groups. Notably, the PPP and PPP+PAE groups more often underwent laparotomy (67.6% and 65.2% vs. 23.6%, $p < 0.001$)

TABLE 2. Comparison of Additional Interventions or Procedures Performed on Subjects Undergoing PPP Alone, PAE Alone, or PPP-PAE

	Total (N = 524)	PPP (n = 68)	PAE (n = 390)	PPP+PAE (n = 66)	p*
Pelvic binder	302 (57.6)	34 (50.0)	224 (57.4)	44 (66.7)	0.15
Pelvic external fixation	69 (13.2)	6 (8.8)	42 (10.8)	21 (31.8)	<0.001
REBOA	38 (7.3)	6 (8.8)	23 (5.9)	9 (13.6)	0.070
Laparotomy	181 (34.5)	46 (67.6)	92 (23.6)	43 (65.2)	<0.001
Thoracotomy	29 (5.5)	14 (20.6)	10 (2.6)	5 (7.6)	<0.001
Craniectomy/craniotomy	11 (2.1)	1 (1.5)	8 (2.1)	2 (3.0)	0.81

*p Values refer to a comparison of PPP, PAE, and PPP-PAE.
All values are reported as number (%).
REBOA, resuscitative endovascular balloon occlusion of the aorta.

TABLE 1. Comparison of Baseline Characteristics Between Subjects Receiving PPP Alone, PAE Alone, and PPP+PAE

	Total (N = 524)	PPP (n = 68)	PAE (n = 390)	PPP+PAE (n = 66)	p*
Age, y	50 ± 19	46 ± 17	51 ± 19	46 ± 19	0.028
Male sex, n (%)	363 (69.3)	47 (69.1)	265 (67.9)	51 (77.3)	0.32
ISS	34 (24–45)	41 (28.5–50)	34 (22–43)	43 (29–50)	<0.001
AIS					
Head	1 (0–3)	2 (0–3)	1 (0–3)	2 (0–4)	0.023
Chest	3 (1–3)	3 (1–4)	3 (1–3)	3 (0–3)	0.18
Abdomen	3 (2–4)	3 (2–4)	3 (1–4)	3 (2–4)	0.001
Extremity	4 (3–5)	4 (3–5)	4 (3–5)	5 (4–5)	0.011
Admission SBP, mm Hg	98 (80–123)	93 (70–133)	100 (82–123)	89 (74–110)	0.028
Admission HR, bpm	106 (86–127)	108 (91–129)	105 (83–124)	118 (103–140)	0.003
Admission GCS	14 (6–15)	10 (3–14)	14 (7–15)	12 (4–15)	<0.001
Lowest SBP, mm Hg	72 (61–82)	62 (53–76)	74 (64–84)	70 (59–77)	<0.001
Admission lactate, mmol/L	4.8 (3.2–7.5)	6.4 (4.2–8.9)	4.3 (2.9–6.9)	6.9 (4.8–8.6)	<0.001
Admission base deficit	−6.8 (−11.0 to −3.0)	−8.0 (−13.3 to −2.4)	−6.0 (−10.0 to −3.0)	−8.0 (−13.0 to −2.0)	0.35
pRBC in 6 h, L	1.4 (0.7–2.8)	2.1 (0.9–4.5)	1.2 (0.6–2.1)	2.9 (1.7–6.8)	<0.001
Whole blood in 6 h, L	0 (0–1)	0.8 (0–1.5)	0 (0–1)	0 (0–1.8)	0.019

*p Values refer to a comparison of PPP, PAE, and PPP-PAE.
Unless specified, values are reported as mean ± SD or median (IQR).
AIS, Abbreviated Injury Scale score; bpm, beats per minute; GCS, Glasgow Coma Score; HR, heart rate; ISS, Injury Severity Score; SBP, systolic blood pressure.

TABLE 3. Outcomes by Subjects Who Underwent PPP Alone, PAE Alone, or PPP-PAE

	Total (N = 524)	PPP (n = 68)	PAE (n = 390)	PPP+PAE (n = 66)	*p**
Ventilator days**	4 (0–10)	6 (3–12.5)	3 (0–8)	8.5 (5–21.5)	<0.001
Hospital LOS**	23 (14–39)	10.5 (1–27)	18 (10–33)	21.5 (6–43)	<0.001
ICU LOS**	8 (4–18)	10 (7–15)	7 (4–16)	19 (10–28.5)	<0.001
Mortality, n (%)					
At 3 h	21 (4.0)	19 (27.9)	2 (0.5)	0 (0)	<0.001
At 6 h	28 (5.3)	21 (30.9)	7 (1.8)	0 (0)	<0.001
At 24 h	50 (9.5)	26 (38.2)	16 (4.1)	8 (12.1)	<0.001
In-hospital	130 (24.8)	32 (47.1)	72 (18.5)	26 (39.4)	<0.001

*p Values refer to a direct comparison between PPP, PAE, and PPP+PAE.
**Reported values are for survivors only (n = 394).

and thoracotomy (20.6% and 7.6% vs. 2.6%, $p < 0.001$) compared with the PAE group.

In-hospital mortality was 24.8%, with death occurring in 47% of subjects in the PPP group, 39% of subjects in the PPP+PAE group, and 18.5% of subjects in the PAE group (Table 3). At 3, 6, and 24 hours after admission, the PPP group had significantly higher mortality than the PAE group. A stable hematocrit, defined as a 3% or less difference in hematocrit on two checks at least 6 hours apart, was achieved in 56% of subjects in the PPP group, 67% of subjects in the PPP-PAE group, and 82% of subjects in the PAE group ($p < 0.001$). The median time to achieve a stable hematocrit was 40 hours (IQR, 63.5 hours) in the PPP group, 71.5 hours (IQR, 79.5 hours) in the PPP+PAE group, and 42 hours (IQR, 76 hours) in the PAE group. When investigators were queried as to whether ongoing pelvic hemorrhage contributed to death, they responded affirmatively in 47% of PPP cases, 42% of PPP+PAE cases, and 10% of PAE cases.

On multivariable regression analysis for risk of mortality, when compared with PAE, PPP was associated with a 64-fold greater odds of death at 3 hours (confidence interval [CI], 8.8–465.1; AUROC, 0.95), 15 times greater odds of death at 6 hours (CI, 4.4–51.7; AUROC, 0.89), and 10 times greater odds of death at 24 hours (CI, 3.7–24.9; AUROC, 0.87) (Table 4). Sensitivity analysis for 3- and 6-hour mortality demonstrated that a confounder would need to have an odds ratio of 17 and 6, respectively, while accounting for all the other covariates in the model to explain away the association between PPP versus PAE and mortality. For the IPTW analysis, only serum lactate had missing values (n = 129), which were imputed using the previously described method. Results demonstrated a 19.4% higher probability of death at 6 hours for subjects in the PPP versus PAE group, with an estimated baseline mortality of 1.9% if all subjects had received PAE ($p < 0.001$).

DISCUSSION

This large, multicenter observational study aimed to evaluate outcomes of preperitoneal pelvic packing versus pelvic angioembolization in patients with hemorrhagic shock due to PRFs. Results demonstrate that PAE remains the predominant HCI used for patients with PRFs and hemorrhagic shock at Level I trauma centers. Although PPP is used infrequently, it is typically reserved for patients in the most severe states of hemorrhagic shock, who have markedly lower survival. This is evidenced by higher ISS scores, greater transfusion volumes, and more severe physiological and laboratory abnormalities among individuals who received PPP. When used in combination, PPP is often applied first, followed by PAE if there is ongoing

TABLE 4. Multivariable Logistic Regression Model Estimating the Effect of PPP Versus PAE on Mortality at 3, 6, and 24 Hours*

	Death at 3 h			Death at 6 h			Death at 24 h		
	OR	CI	*p*	OR	CI	*p*	OR	CI	*p*
PPP**	64.0	8.8–465.1	<0.001	15.1	4.4–51.7	<0.001	9.6	3.7–24.9	<0.001
Age	1.0	0.99–1.09	0.061	1.0	1.0–1.1	0.018	1.04	1.01–1.07	0.003
Sex	1.1	0.24–5.2	0.897	0.7	0.2–2.5	0.608	0.8	0.3–2.1	0.699
Lactate	1.2	1.0–1.37	0.048	1.2	1.0–1.3	0.027	1.11	1.00–1.23	0.044
ISS	1.0	0.9–1.1	0.887	1.0	1.0–1.1	0.473	1.03	1.00–1.07	0.040
Abdomen AIS	0.9	0.5–1.6	0.807	0.9	0.6–1.3	0.492	0.97	0.7–1.3	0.893
Lowest SBP	1.0	0.9–1.0	0.175	1.0	0.9–1.0	0.158	1.0	0.97–1.03	0.263
Admission GCS	1.0	0.9–1.2	0.845	0.9	0.8–1.1	0.364	0.9	0.8–1.0	0.067
REBOA	7.0	0.8–55.6	0.066	5.5	1.2–24.2	0.026	2.8	0.8–10.3	0.112

*Subjects receiving PPP+PAE were excluded.
**The PAE group was used as a reference.
AIS, Abbreviated Injury Scale score; CI, confidence interval; ISS, Injury Severity Score; GCS, Glasgow Coma Score; OR, odds ratio; REBOA, resuscitative endovascular balloon occlusion of the aorta; SBP, systolic blood pressure.

bleeding. In addition, patients are more likely to undergo PPP as opposed to PAE at the time of laparotomy and/or thoracotomy, further underscoring the multicompartmental nature of injuries sustained by pelvic fracture patients and the limitations of performing PAE in individuals who have additional sources of hemorrhage that require surgical control.

Results from the multivariable logistic regression model evaluating 3- and 6-hour all-cause mortality suggest that, for all-comers, PAE is an effective method of controlling hemorrhagic shock due to PRFs. The vast differences in physiology between the PAE and PPP groups, however, obfuscate any direct comparison of the two interventions. The lower mortality of individuals who received combined PAE and PPP over PPP alone is likely an indicator of survival bias rather than the superiority of PAE over PPP.

The use of 3- and 6-hour all-cause mortality endpoints for this study is in line with the current recommendation by the National Institutes of Health as the preferred primary outcomes for studies evaluating hemostatic interventions in trauma patients with hemorrhagic shock.[12] This is owing to the fact that most hemorrhagic shock–associated deaths occur within 6 hours, whereas later deaths are due to non–hemorrhage-related causes (traumatic brain injury, sepsis, respiratory failure, etc.). A recent retrospective analysis of HCIs in pelvic fracture management in the American College of Surgeons Trauma Quality Improvement Program database also identified positive outcomes with regard to PAE. This study, published by Anand et al.,[1] found that only PAE was associated with a reduction in in-hospital mortality, whereas PPP was associated with a higher odds of major complications.

It is important to note, however, that, although PAE appears to be the preferred first-line HCI in this study population, there are significant clinical differences between the PPP and PAE cohorts that cannot be entirely mitigated with a regression model. There is no standardized definition for hemodynamic instability, and the inclusion criteria for this study were broad enough that almost half of the study population stabilized without an HCI. Close to a quarter of patients who received PAE did so for active contrast extravasation or pelvic hematoma on axial imaging, which implies lower severity of bleeding, as opposed to ongoing hemorrhage.[13] This contrasts with the PPP cohort, all of which received packing for the purposes of hemorrhage control. It is possible that there is a subgroup of patients with severe uncontrolled hemorrhage that may benefit from PPP over PAE, especially given the lack of delays associated with waiting for an endovascular specialist when proceeding directly to PPP. A single-center retrospective review found that median time to pelvic angiography was nearly 5 hours, with 35% of deaths attributable to ongoing hemorrhage.[14] A separate study evaluating outcomes among patients who received Zone III REBOA for the management of bleeding due to pelvic fractures in the AAST Aortic Occlusion for Resuscitation in Trauma and Acute Care Surgery database found similar rates of mortality for PPP (38.6%) and PAE (32.1%), with PPP used more often than PAE.[15] In-hospital mortality for these patients was 37.7%, considerably higher than in our study. A retrospective, propensity-matched study using American College of Surgeons Trauma Quality Improvement Program found no difference in mortality between PAE and PPP.[16] These findings highlight the need to further define and study the subpopulation of patients with blunt pelvic fractures and severe hemorrhagic shock.

The risks and benefits of the two interventions are varied, which play a role in their adoption and acceptability across trauma centers.[17] Whereas PPP requires a surgical incision and a minimum of two trips to the operating room, PAE offers a less invasive and more definitive option. Concerns regarding hardware infections and surgical site infections have pushed centers away from adopting PPP as a more routine practice.[18] Aggressive PAE, however, has been posited to be associated with pelvic ischemia and gluteal necrosis, although this was disproven in a recent study.[19] Most importantly, the delay in access to an endovascular specialist who can perform PAE as opposed to a trauma surgeon who can perform PPP lends itself to the latter intervention being reserved for patients who need rapid hemorrhage control.[14] The differences in resource requirements, engrained trauma center preferences, and lack of national guidelines as it pertains to PPP and PAE further complicate research efforts.

There are several limitations to this study that must be noted. All centers that participated in this study were Level I centers with the ability to access endovascular services within 1 hour. Centers that do not have this capability may need to proceed to PPP in the setting of significant hemorrhage, even if PAE might be preferred. In this study, PAE was performed more frequently than PPP at all participating centers, with PPP being used rarely, if at all, at some centers. Although the technique of PPP is not difficult, lack of experience with the technique and/or clear protocols regarding its use might have adversely affected outcomes. High-volume users of PPP, which have previously published their success with the procedure in conjunction with concomitant external fixation,[20,21] may have better outcomes with PPP than were reported in this study. As is true with all observational studies, there may be additional confounders that were not collected and/or unknown that could have influenced the primary outcomes (mortality), which can only be controlled with a randomized clinical trial.

CONCLUSION

In this multicenter, observational study of patients with blunt PRFs presenting in shock, we found that PAE, compared with PPP, is the predominant intervention used for hemorrhage control. Preperitoneal pelvic packing is used for patients with a greater degree of hemorrhagic shock who ultimately have lower survival. After accounting for known confounders using a multivariable regression model, recipients of PPP had 15 times greater odds of death at 6 hours than recipients of PAE. These findings suggest that, at centers with rapid access to endovascular specialists, PAE is an appropriate first-line intervention for the majority of patients with significant bleeding from blunt PRFs, with PPP reserved for those in severe, persistent hemorrhagic shock or requiring other major operative interventions. Further clinical trials are needed to determine which subpopulation of patients with shock from PRFs would benefit from PPP over PAE as first line therapy.

AUTHORSHIP

All authors contributed to the manuscript as members of a multicenter study, which included data collection, data entry, manuscript writing, and critical revisions, and can be acknowledged as part of a working group.

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DISCLOSURE

Conflicts of Interest: Author Disclosure forms have been supplied and are provided as Supplemental Digital Content (http://links.lww.com/TA/F37).

Members of AAST HIPS Study Group: Jessica Keeley, MD, Harbor UCLA Medical Center; Bryana Baginski, MD, Baylor Scott & White Medical Center, Dallas; Jennifer Mooney, MD, Baylor Scott & White Medical Center, Dallas; Arvin Gee, MD, Legacy Emanuel Medical Center; Samantha Underwood, MS, Oregon Health & Science University Medical Center; Erika Bisgaard, MD, University of Washington Medical Center; Scott Brakenridge, MD, University of Washington Medical Center; Joshua Dilday, DO, Medical College of Wisconsin; Morgan Schellenberg, MD, St. Michael's Hospital, Toronto; Claudia Alvarez, MD, University of California—Irvine Medical Center; Jeffry Nahmias, University of California-Irvine Medical Center; Matthew Kochuba, MD, University of Florida Jacksonville Medical Center; Yohann Diaz Zuniga, MD, University of Florida Jacksonville Medical Center; Jeanette Zhang, MD, Tulane University Medical Center; Mallory Loe, MD, Tulane University Medical Center; Emily Rady, MD, OhioHealth Grant Medical Center; Michal Radomski, MD, OhioHealth Grant Medical Center; Marinda Scrushy, MD, UT Southwestern Medical Center; Brandon Bruns, MD, UT Southwestern Medical Center; Rachel Cary, MD, Rutgers Robert Wood Johnson University Hospital; Rachel Choron, MD, Rutgers Robert Wood Johnson University Hospital; Melissa Kost, MD, University of Arkansas Medical Center; Lillian Jones, BS, University of Arkansas Medical Center; Cordelie Witt, MD, Medical Center of the Rockies; Jacob Lilienfeld, BA, Medical Center of the Rockies; Andrew Medvecz, MD, Vanderbilt University Medical Center; Bradley Matthew Dennis, MD, Vanderbilt University Medical Center; Ashley Farhat-Sabet, MD, SUNY Upstate Medical Center; Roseanna Guzman-Curtis, MD, SUNY Upstate Medical Center; Laura Haines, MD, UC San Diego Medical Center; Todd Costantini, MD, Department of Surgery, University of Minnesota; Michael Cripps, MD, University of Colorado Medical Center; Shane Urban, BSN, RN, University of Colorado Medical Center; Raul Coimbra, MD, Riverside University Health System; Rahul Tuli, MD, UC Riverside School of Medicine; Alexander A. Fokin, MD, Delray Medical Center; Joanna Wycech, MS, Delray Medical Center; Kaushik Mukherjee, MD, Loma Linda University Health; Sina Asaadi, MD, Loma Linda University Health; Walter L. Biffl, MD, Scripps Memorial Hospital La Jolla; Dunya Bayat, MPH, Scripps Memorial Hospital; Jason Murry, MD, University of Texas at Tyler; Brandi Pero, RN, University of Texas at Tyler; Megan Gilbert, MD, UC Davis Health; David Shatz, MD, UC Davis Health; Dalier Rodriguez Mederos, MD, Broward Health Medical Center; Ivan Puente, MD, Broward Health Medical Center; Mamadou Korse, BS, Dell Medical Center at UT Austin; Chad Hall, MD, Baylor Scott & White Medical Center, Temple; Richard Vargas, BS, Baylor Scott & White Medical Center, Temple; Megan Quintana, MD, George Washington University Medical Center; Elisabeth Merten, MEd, George Washington University Medical Center; Aditi Kapil, MD, Yale New Haven Hospital; Bishwajit Bhattacharya, MD, Yale New Haven Hospital; Chelsea McDermott, MD, Medstar Washington Hospital Center; Christine Trankiem, MD, Medstar Washington Hospital Center; Megan Gross, MD, University of Tennessee Health Science Center, Memphis; Thomas Easterday, MD, University of Tennessee Health Science Center, Memphis; Jordan Kirsch, MD, Westchester Medical Center; Aryan Rafieezadeh, MD, Westchester Medical Center; Jessica Burgess, MD, Eastern Virginia Medical School; Megan Ralston, MD, Eastern Virginia Medical School; Jocelyn Hunter Rose, Kansas University Medical Center; Christopher Guidry, MD, Kansas University Medical Center; Chad G. Ball, MD, University of Calgary; Nikolay Bugaev, MD, Tufts Medical Center; Ritika Dinesh, BS, Tufts Medical Center; Stephanie Bonne, MD, Wake Forest University School of Medicine; Melissa Blatt, BSN, Hackensack University Medical Center; James Haan, MD, Ascension Via Christi Hospital; Kelly Lightwine, MPH, Ascension Via Christi Hospital; Zsolt J. Balogh, MD, John Hunter Hospital; Angela Fischer, RN, John Hunter Hospital; Benjamin Moran, MD, Einstein Medical Center; Afshin Parsikia, MD, MPH, Einstein Medical Center; Daniel Ricaurte, MD, Hartford Healthcare; Hannah Luu, MD, Hartford Healthcare; Yassar Hashim, MD, Cedars-Sinai Medical Center; Galinos Barmparas, MD, Cedars-Sinai Medical Center; James Byrne, MD, Vancouver General Hospital; Zakk Arciaga, MSN, Johns Hopkins Hospital; Katherine Florecki, MD, Johns Hopkins Hospital; Elliott Haut, MD, Johns Hopkins Hospital; Husayn Ladhani, MD, Loma Linda University Health; Renaldo Williams, MD, Denver Health; John Holcomb, MD, University of Alabama at Birmingham; Thomas M. Scalea, MD, University of Maryland Medical Center.

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