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ROLE OF ANGIOEMBOLIZATION IN ABDOMINOPELVIC TRAUMA PATIENTS: RESULTS OF ANGIOEMBOLIZATION AND EFFECT OF TIME DURATION BETWEEN TRAUMA AND EMBOLIZATION PROCEDURE

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ABSTRACT

Objective: The proposed study aims to look at the outcomes of angioembolization in terms of survival, blood transfusions, length of ICU stay, and overall stay, need for surgical exploration.

Methods: After the ethical approval from institutional review, this prospective observational study was conducted in the emergency Shaheed Mohtarma Benazir Bhutto Institute of Trauma (SMBBIT) from ---------- to ----------. Through non-probability consecutive sampling, 72 patients aged 18 or above, both genders, with abdominopelvic injury and undergoing angioembolization were included in the study. Clinical outcomes following angioembolization were meticulously recorded, encompassing measures such as mortality rates, rates of successful hemostasis, length of hospital stay, need for surgical intervention, and incidence of complications such as rebleeding or ischemic complications.

Results: The average injury severity score of the participants was 29.32±10.16. Technical success and clinical success rates in the present study were 82% and 85% respectively. Rebleed was observed in 4% of the individuals. The average hospital

	length stay was 43.32±23.2 days. A 15% mortality rate was observed in the present study. **Conclusion**: Angioembolization is a highly effective procedure that can be used to halt bleeding and provide support for non-surgical treatment of both solid organ damage and pelvic fractures. With meticulous selection and effective implementation, it boasts a remarkable success record.

INTRODUCTION

Abdominal-pelvic trauma continues to be a major global cause of morbidity and mortality, posing a challenging clinical case for medical professionals (1, 2). Angioembolization has become a significant method for treating severe injuries, especially when there is vascular impairment. It is one of the many therapy options available. Angioembolization involves the targeted closure of blood arteries that provide blood to damaged organs or tissues (3). This procedure effectively manages bleeding and maintains the function of the affected organ (4). This method has transformed the way abdominopelvic trauma is managed by providing a less intrusive option for surgical investigation for carefully chosen patients.
Gaining a thorough comprehension of the significance of angioembolization in patients with abdominopelvic injuries is crucial for improving patient outcomes and enhancing clinical protocols. Various factors impact the effectiveness and results of angioembolization, such as the location of the damage, the degree of vascular involvement, and the timing of the intervention at the start of the trauma. The impact of the time interval between trauma and embolization operation on patient outcomes is particularly noteworthy since prompt intervention is essential for preventing more bleeding and reducing ischemia damage to key organs (5).

In recent years, there have been major advancements in the care of abdominopelvic injuries. There is now a greater focus on using minimally invasive techniques, such as angioembolization (6). Several studies have examined the effectiveness and results of angioembolization in trauma patients, emphasizing its significance as a secure and efficient technique for managing bleeding and maintaining organ function.
In a retrospective study conducted by Smith et al. (2020), the researchers examined the results of angioembolization in 150 patients with abdominopelvic injuries. The study found that the procedure was successful in attaining hemostasis in 85% of the cases. The study additionally showed that initiating angioembolization within 6 hours of trauma was linked to considerably reduced fatality rates compared to delayed intervention (7). Furthermore, a comprehensive examination and statistical analysis carried out by Muntasar et al. (2018) assessed the influence of timing on the results of angioembolization in patients with trauma. The analysis encompassed 12 trials, involving a collective of 800 patients. It unveiled that performing angioembolization after 6 hours of trauma resulted in lower complication rates and enhanced survival outcomes as compared to intervening at a later stage(8).
In contrast to these results, retrospective cohort research conducted by Agri et al. (2019) revealed no notable disparity in mortality rates between the groups that underwent early and delayed angioembolization. Nevertheless, the study saw a pattern indicating improved results with prompt care, especially in those with hemodynamically unstable pelvic fractures (9). The ideal timing for angioembolization is still a matter of discussion, as there is contradictory evidence about its effect on patient outcomes. Various factors, such as the specific way in

which the injury occurred, the stability of the patient's blood circulation, and the accessibility of necessary resources, might affect when medical intervention is performed in clinical settings. Additional future research is necessary to clarify the optimal timeframe for angioembolization and its impact on patient treatment in abdominopelvic injuries. The proposed study aims to look at the outcomes of angioembolization in terms of survival, blood transfusions, length of ICU stay, and overall stay, need for surgical exploration.

METHODOLOGY

After the ethical approval from institutional review, this prospective observational study was conducted in the emergency Shaheed Mohtarma Benazir Bhutto Institute of Trauma (SMBBIT) from ---------- to ----------. Through non-probability consecutive sampling, 72 patients aged 18 or above, both genders, with abdominopelvic injury and undergoing angioembolization were included in the study. Patients with poly-trauma, head injury, and chest injury were excluded from the study. After the informed consent from the recruited participant, patient data were collected from medical records, trauma registries, and electronic databases. This includes demographic details such as age, sex, and mechanism of injury, as well as clinical parameters such as vital signs, injury severity scores, and imaging findings. Subsequently, details regarding the angioembolization procedure were documented, including the indication for intervention, anatomical location of the injury, and procedural complications. Clinical outcomes following angioembolization were meticulously recorded, encompassing measures such as mortality rates, rates of successful hemostasis, length of hospital stay, need for surgical intervention, and incidence of complications such as rebleeding or ischemic complications. Follow-up data was also collected to assess long-term outcomes and functional recovery in survivors. The SPSS Statistics program (version 21), was used for the statistical analysis. For the analysis of qualitative variables, the chi-squared test and Fisher's exact test were used to compare. Nonparametric tests (Mann-Whitney U) were used to compare quantitative variables. A p-value less than 0.05 will be considered statistically significant.

RESULT

Table 1 shows the clinical and demographic parameters of the recruited participants. The mean age of the patients was 34.56±12.56 years. In the present study, the male-to-female ratio is 3:1. Most common mode of trauma was road traffic accidents (75%). The average injury severity score of the participants was 29.32±10.16. Baseline hemodynamic variables were Pulse rate-98.45±5.33, SBP-120.43±13.2, DBP-78.43±12.3, and GCS-12±3.2. Table 2 shows the Embolization characteristics performed on the study patients. Technical success and clinical success rates in the present study were 82% and 85% respectively. Rebleed was observed in 4% of the individuals. The average hospital length stay was 43.32±23.2 days. A 15% mortality rate was observed in the present study. Table 3 shows the stratification of solid organ damage concerning patients' clinical parameters.

Table I: Demographic and clinical parameters of the patients

Variables	Mean or frequency (n=72)
Age (years)	34.56±12.56
Male: Female ratio	3:1
Mechanism of Injury	
RTA	54 (75%)
Fall	15 (21%)
Assault	3 (4%)
Time of presentation after trauma (Hours)	2.4±3.4
Injury severity score	29.32±10.16

ISS>155	53 (74%)
Initial vitals	
Pulse rate	98.45±5.33
SBP	120.43±13.2
DBP	78.43±12.3
GCS	12±3.2
Arterial embolization	
Renal	7 (9%)
Hepatic	24 (33%)
splenic	36 (50%)
Pelvic	5 (7%)
Follow-up days	56±10.44

Table II: Embolization characteristics

Variables	N(%) (n=72)
Timing of embolization	
No surgical intervention	23 (32%)
Before surgery	19 (26%)
After surgery	25 (38%)
Before and after surgery	5 (8%)
Indication for embolization	
Active blood on CT	45 (69%)
Blush on CT scan	32 (49%)
Pseudoaneurysm	23 (35%)
True aneurysm	2 (3%)
Intraoperative bleeding	10 (14%)
Active bleeding and Pseudoaneurysm	15 (21%)
Technical success	59 (82%)
Clinical success	61 (85%)
Re-Bleed	3 (4%)
Complications	
Infarction needs surgical intervention	10 (14%)
Hepatic failure	1 (1%)
Abscess	3 (4%)
Infections	6 (8%)
Blood transfusion	32 (44%)
ICU length of stay	20.45±5.4
Hospital length stay	43.32±23.2
Mortality	10 (14%)

Table III: Stratification of solid organ damage concerning patients' clinical parameters.

Variables	Renal (n=7)	Hepatic (n=24)	Splenic (n=36)	Pelvic (n=5)	P value
Age	32.66±11.56	35.16±13.26	31.45±12.1	32.35±10.1	0.404
Injury severity score	28.24±9.26	31.06±8.12	29.45±12.1	30.35±10.1	0.051*

Shock index ≥0.80	3(55%)	20 (83)%	19 (52%)	3 (60%)	0.211
Surgical intervention					0.240
No surgical intervention	3 (42%)	9 (79%)	8 (78%)	3 (60%)	
Before surgery	0	6 (42%)	13 (25%)	0	
After surgery	4 (43%)	6 (46%)	13 (28%)	2 (40%)	
Before and after surgery	0	3 (13%)	2 (5%)	0	
Technical success	6 (86%)	22 (92%)	33 (92%)	5 (100%)	0.854
Clinical success	7 (100%)	22 (92%)	34 (94%)	5 (100%)	0.787
Blood transfusion	3 (43%)	12 (50%)	12 (33%)	5 (100%)	0.039*
ICU length of stay	6.5±1.2	14.32±2.3	3.2±1.4	5.5±1.32	<0.001****
Hospital length stay	10.03±2.3	24.34±8.2	5.45±3.4	8.4±3.45	<0.001****
Mortality	1 (14%)	4 (17%)	2 (8%)	3 (60%)	0.011*

DISCUSSION

In the present study, the overall frequency of angioembolization among the total trauma admissions was 2%. The bulk of the individuals were young males who experienced severe multiple injuries, resulting in a high Injury Severity Score (ISS). The spleen was the most often embolized organ, followed by the liver and kidney. Prior research has demonstrated that a shock index of ≥0.80 following an injury can serve as a reliable indicator for predicting the early requirement of massive transfusion protocol (MTP), laparotomy, and fatality (10). The investigation revealed that the average shock index for the group was higher than 0.80, with a particularly higher value observed in cases of post-hepatic injury (SI=0.91) and pelvic injury (SI=0.90). The majority of patients in this study underwent a first CT scan that was determined based on their hemodynamic status. The decision to do angioembolization as part of the non-operative management (NOM) was mostly based on the CT findings in most cases. Patients experiencing hemodynamic instability underwent Damage Control Surgery (DCS) followed by angioembolization, based on the findings observed during the surgery. The use of blush as a reliable indicator for angioembolization is still a subject of debate.

Nevertheless, it continues to be a significant risk factor for the failure of NOM for solid organ injury (11). Nevertheless, Diamond et al. found that approximately 50% of patients may not require any procedures, particularly in the retroperitoneum and pelvis regions, regardless of the magnitude or volume of the bleeding (11).

Our total success rate was 85% which is considerably lower than the success rate of Velmahos et al's series in Los Angeles, who reported a 91% success rate but with a greater number of pelvic injury cases (12). In general, the high rates of success, both in terms of clinical outcomes and technical performance, align with the reported range of 100%, with an average (13). Recurrent hemorrhaging following the initial angioembolization procedure can be effectively managed with subsequent angioembolization procedures. Our complication rates, such as re-bleeding, necrosis, and infection, are relatively low. The mortality rate during angioembolization often falls within the range of 16% to 50% and is frequently linked to the presence of concomitant injuries(14).

CONCLUSION

Angioembolization is a very efficient process that can be employed to stop bleeding and offer assistance for non-surgical therapy of both solid organ injury and pelvic fractures. By carefully choosing and skillfully executing, it has an impressive track record of success.

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