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Surgical Treatment Outcomes for Concurrent Traumatic Rib Fractures and Extrapleural Hematoma: An Integrated Analysis

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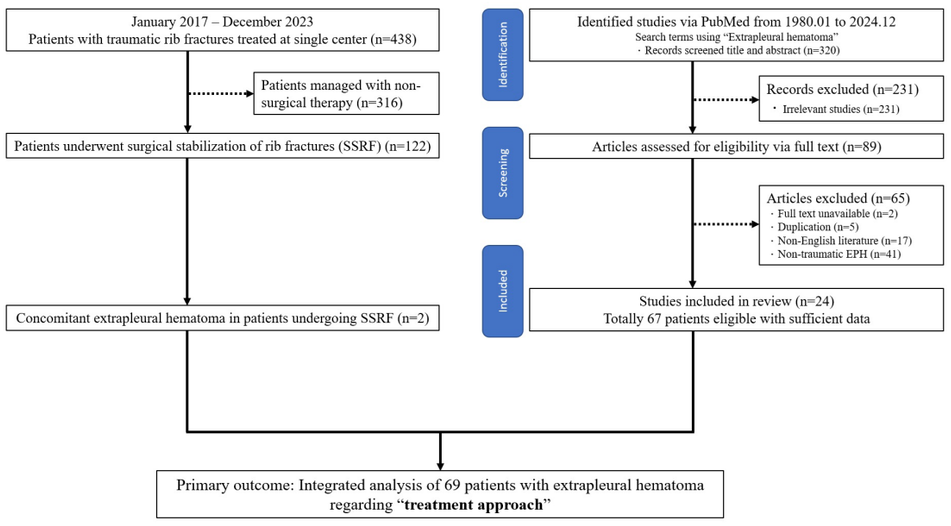
Background & Methods

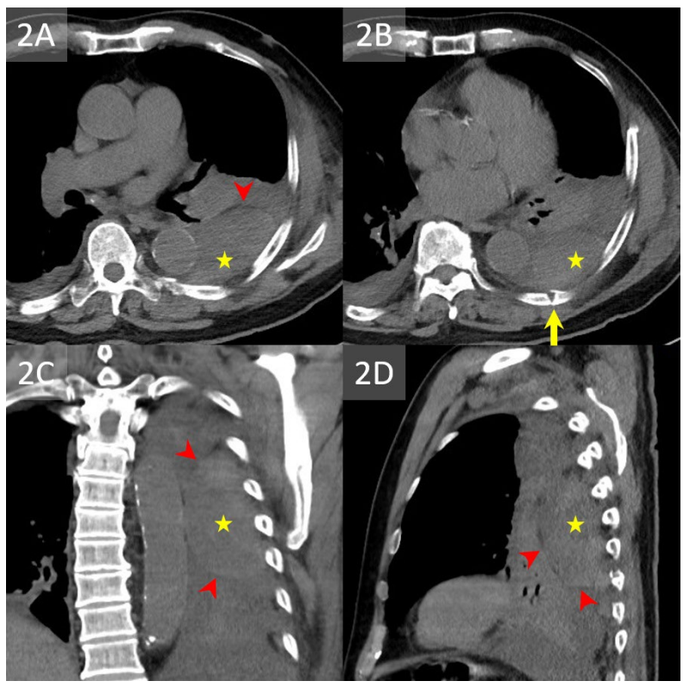
Pneumothorax and hemothorax are common complications of traumatic rib fractures, but in some cases, intercostal vessel injuries can cause extrapleural hematomas (EPH). Typically managed conservatively, intervention is required for active bleeding or hematoma expansion. Thoracoscopic management of traumatic EPH remains rare, and while SSRF has gained traction, the surgical treatment of concurrent EPH and rib fractures is not well documented. This study retrospectively analyzes a single-institution experience with concurrent SSRF and EPH surgery. Additionally, a systematic literature review and pooled analysis of EPH treatment approaches were conducted. A total of 67 patients were identified from 24 included articles. Combined with our two institutional cases, an integrated analysis of 69 patients was performed to assess treatment approaches (see below, **Figure 1**).

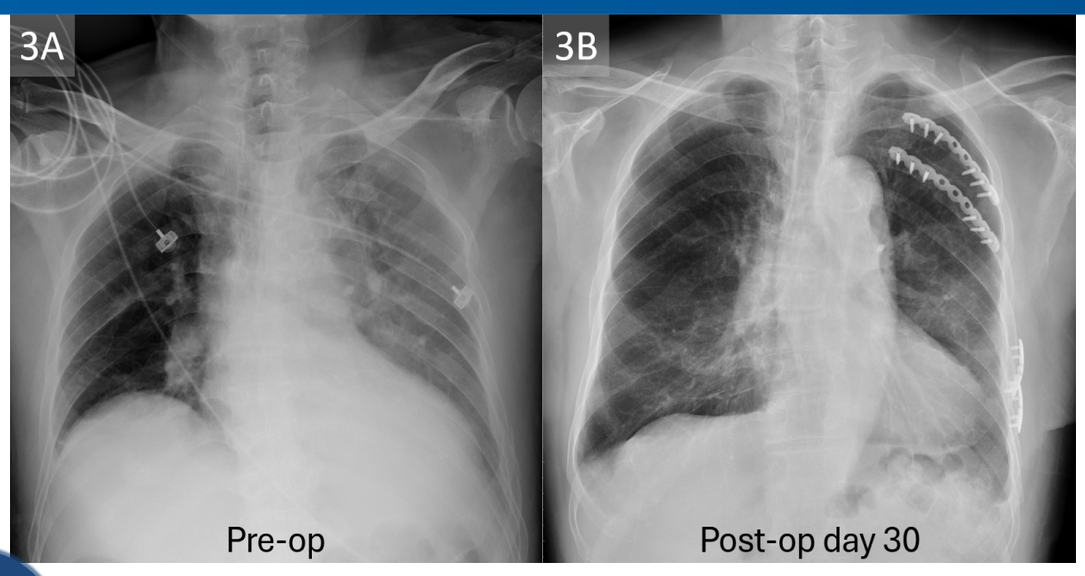


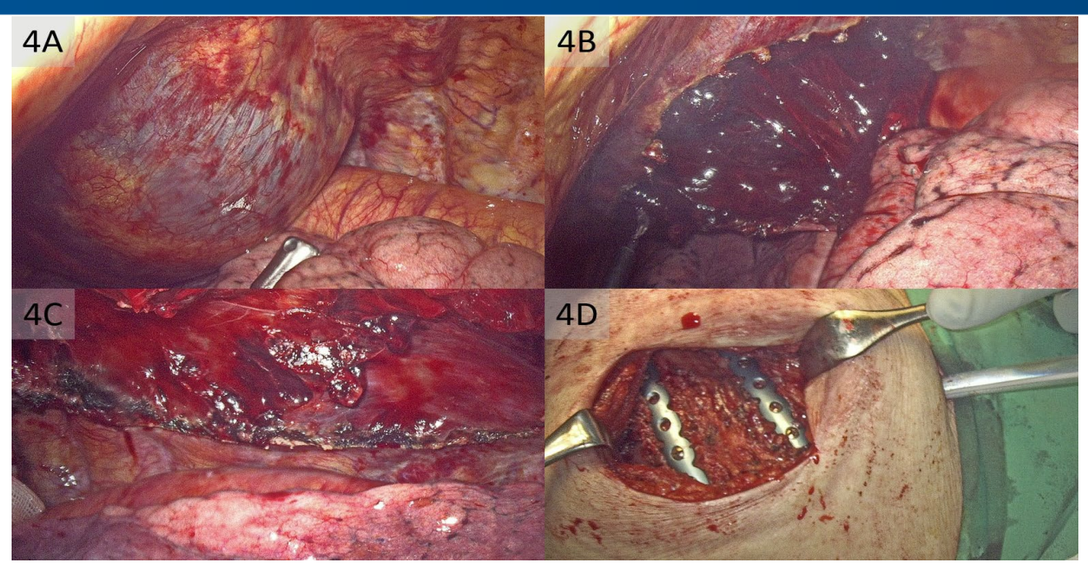
Case presentation

We present a case of an 82-year-old male with no comorbidities or anticoagulant use who sustained a head and left chest injury in a motor vehicle collision. CT imaging revealed left 3rd–10th rib fractures, a giant left EPH, hemothorax, and mild subdural hemorrhage (**Figure 2**). A follow-up chest radiograph showed worsening EPH or hemothorax (**Figure 3A**).

On post-trauma day 7, the patient underwent thoracoscopic evacuation of an 800-mL EPH with single-lung ventilation and subtotal pleurectomy, followed by SSRF for severely displaced left 4th–7th rib fractures (**Figure 4**). He recovered without complications and was discharged in stable condition. Follow-up imaging confirmed EPH resolution and improved chest wall alignment (**Figure 3B**).







Results

Table 1 summarizes the demographics and clinical data of patients with traumatic EPH reported in the literature. Observation remained the primary treatment (67%), followed by surgery (28.5%). Although **84%** of patients had concurrent rib fractures, only **1.5%** underwent SSRF.

As shown in **Table 2**, 69 patients were analyzed based on treatment approach. Both surgical and non-surgical groups had similar characteristics regarding age, sex, mechanism of injury, trauma type, EPH location, and rib fractures. However, CT scans were significantly more utilized in the surgical group ($p < 0.001$), with a higher prevalence of biconvex-shaped EPH ($p = 0.03$).

A greater proportion of recent literature (2001–2025) reported surgical cases (**91%** vs. **25.5%**, $p < 0.001$), suggesting increased adoption of surgery due to improved diagnostic accuracy. Although not statistically significant, the surgical group had a higher survival rate (100% vs. 91.5%).

Table 1. Demographic and clinical profiles of EPH patients in published studies

Variables	Patients (n =67)
Age, y, median (range)	66 (19 – 90)
Sex, n (%)	
Male	51 (76)
Female	16 (24)
Mechanism of injury, n (%)	
Motor vehicle accidents	28 (41.7)
Fall	30 (44.8)
Stabbing	2 (3)
Miscellaneous	7 (10.5)
Type of trauma, n (%)	
Blunt	65 (97)
Penetrating	2 (3)
Location of EPH, n (%)	
Right	29 (43.3)
Left	35 (52.2)
Bilateral/retrosternal	3 (4.5)
Diagnostic tools, n (%)	
CT scan	32 (48)
Chest X-ray	34 (50.5)
Autopsy	1 (1.5)
Shape of EPH, n (%)	
Biconvex	58 (88)
Nonconvex	8 (12)
Concomitant rib fractures (Yes), n (%)	56 (84)
Surgical stabilization of rib fractures, n (%)	1 (1.5)
Initial treatment approach, n (%)	
Observation	45 (67)
Transarterial embolization (TAE)†	3 (4.5)
Thoracotomy	14 (21)
VATS‡	5 (7.5)
Patient outcome, n (%)	
Alive	63 (94)
Deceased※	4 (6)
Literature period, n (%)	
1980–2000	37 (55.3)
2001–2024	30 (44.7)

Table 2. Clinical outcome comparison of successful treatment approaches for traumatic EPH

Variables	Non-surgery (n = 47)	Surgery (n = 22)	p-value
Age, median (range)	64 (19-90)	68 (21-88)	0.66
Sex, n (%)			
Male	33 (70)	20 (91)	0.07
Female	14 (30)	2 (9)	
Mechanism of injury, n (%)			
Motor vehicle accidents	21 (44.6)	9 (40.9)	0.93
Fall	20 (42.5)	10 (45.4)	
Stabbing	1 (2.1)	1 (4.5)	
Miscellaneous	5 (10.6)	2 (9.0)	
Type of trauma, n (%)			
Blunt	46 (97.8)	21 (95.4)	0.54
Penetrating	1 (2.1)	1 (4.5)	
Location of EPH, n (%)			
Right	22 (46.8)	7 (31.8)	0.18
Left	22 (46.8)	15 (68.2)	
Bilateral/retrosternal	3 (6.4)	0 (0)	
Diagnostic tools, n (%)			
CT scan	12 (25.5)	22 (100)	***<0.001***
Chest X-ray	34 (72.3)	0 (0)	
Autopsy	1 (2.1)	0 (0)	
Shape of EPH, n (%)#			
Biconvex	38 (82.6)	22 (100)	***0.03***
Nonconvex	8 (17.4)	0 (0)	
Concomitant rib fractures, (Yes), n (%)	39 (83)	17 (77)	0.74
Patient outcome, n (%)			
Alive	43 (91.5)	22 (100)	0.29
Deceased※	4 (8.5)	0 (0)	
Literature (case) period, n (%)			
1980–2000	35 (74.5)	2 (9)	***<0.001***
2001–2025	12 (25.5)	20 (91)	

(#), only 68 patients available for analysis (46 versus 22, respectively); (†), TAE failed in one of the three patients, necessitating subsequent thoracotomy; (‡), VATS failed in one of the five patients, requiring conversion to thoracotomy; (※), one of the four deceased patients did not die directly from EPH.

Conclusions

Extrapleural hematoma (EPH) is a rare complication of thoracic trauma, with a growing shift toward surgical intervention, particularly in complex cases with rib fractures. Advancements in CT imaging have improved diagnostic accuracy, facilitating early recognition and management. Given the variability in injury severity, treatment should be individualized to optimize outcomes. Simultaneous thoracoscopic evacuation and SSRF represent a viable and effective treatment option for focal EPH and rib fractures following blunt trauma. Awareness of this rare complication is crucial for clinicians managing thoracic trauma. Further research is warranted to establish standardized protocols for managing this complex clinical scenario.