

Early vs Late Definitive Fixation of Pelvic Ring Fractures in Polytraumatized Patients. A Systematic

Review And Meta-Analysis

Oochit KK¹, Imran A², Campton L³, Kelly M³, Gill S³, Marsh A³

1. NHS Dumfries and Galloway, Dumfries

2. School of Medicine, University of Glasgow

3. Pelvic & Major Trauma, Department of Trauma and Orthopaedics, Queen Elizabeth University Hospital, Glasgow



Background

The timing of definitive fixation of pelvic fractures in polytrauma patients is a controversial topic in the trauma literature. Recommendations for early definitive fixation as opposed to a damage control approach with delayed definitive fixation are currently based on the haemodynamic status and response of these critically ill patients to resuscitation, with the advantages of early fracture fixation weighed against the risks of excessive surgical burden.

Aim: Compare short-term clinical outcomes between early (EDF) vs late definitive fixation (LDF) in polytraumatized patients with pelvic ring fractures.

Methods

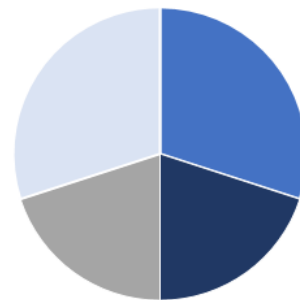
- PRISMA guidelines
- Databases searched: Embase, Medline, Cochrane library
- Methodological quality of studies: Newcastle Ottawa Scale
- Inclusion Criteria: High energy pelvic fractures in polytraumatized patients studies reporting outcomes from EDF and LDF.

Results

- Out of 869 studies, 12 met our inclusion criteria totaling 1986 patients.
- 1110 patients in EDF group vs 876 patients in LDF
- Mean Injury Severity Score of 27.6 in EDF & 26.6 in LDF group.

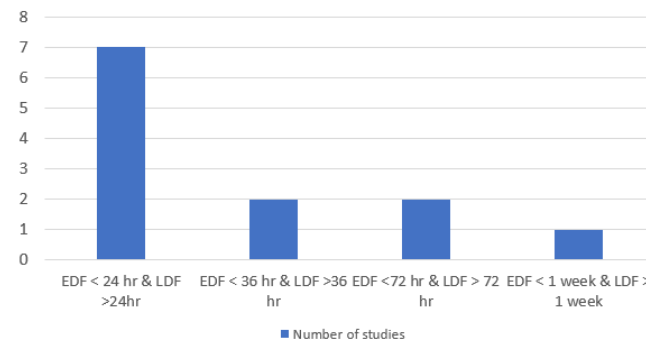
Outcomes	Number of studies	Number of patients: EDF	Number of patients: LDF	RR (95% CI)	WMD (95% CI)	p-value	Heterogeneity
ICU length of stay (days)	7	982	848	-	-0.54 [-2.11, 1.04]	0.50	74%
Acute respiratory distress syndrome	5	985	915	0.50 [0.26, 0.96]	-	0.04	45%
Pneumonia	4	252	401	0.48 [0.20, 1.18]	-	0.11	35%
Pulmonary embolism	3	787	623	1.60 [0.70, 3.64]	-	0.26	0%
Duration of ventilatory post-operatively	3	641	554	-	-1.55 [-3.31, 0.21]	0.08	88%

Reasons for choosing late definitive fixation



- Surgeon's choice
- Availability of pelvic surgeons
- Operation theatres availability
- Transfers from other hospitals

Definitions of early vs late fixation among studies



Mortality

Study or Subgroup	EDF Events	EDF Total	LDF Events	LDF Total	Weight	Risk Ratio
Enninghorst 2010	0	18	3	27	4.6%	0.21 [0.01, 3.85]
Rojas 2021	1	36	3	82	7.8%	0.76 [0.08, 7.05]
Scalea 1999	15	147	4	24	37.5%	0.61 [0.22, 1.69]
Taylor 2022	1	179	0	108	3.8%	1.82 [0.07, 44.20]
Vallier 2010	1	165	4	253	8.1%	0.38 [0.04, 3.40]
Vallier 2013	8	572	7	433	38.2%	0.87 [0.32, 2.37]
Total (95% CI)		1117		927	100.0%	0.68 [0.36, 1.26]
Total events	26		21			
Heterogeneity: Tau ² = 0.00; Chi ² = 1.53, df = 5 (P = 0.91); I ² = 0%						
Test for overall effect: Z = 1.22 (P = 0.22)						

Length of stay (LOS)

Study or Subgroup	EDF Mean	EDF SD	EDF Total	LDF Mean	LDF SD	LDF Total	Weight	Mean Difference
1.1.1 Hospital LOS: EDF < 24h and LDF ≥ 24h								
Enninghorst 2010	25	24	18	37	22	27	1.8%	-12.00 [-25.85, 1.85]
Plaisier 2000	9	4.81	16	14	9.78	25	11.5%	-5.00 [-9.50, -0.50]
Rojas 2021	13	13	36	17	14	82	9.4%	-4.00 [-9.22, 1.22]
Scalea 1999	23	17.8	147	22	13.7	24	7.3%	1.00 [-5.19, 7.19]
Vallier 2010	10.7	11.9	165	11.6	8	253	23.2%	-0.90 [-2.97, 1.17]
Vallier 2013	10.5	9.8	572	14.3	11.4	433	27.5%	-3.80 [-5.14, -2.46]
Subtotal (95% CI)			954			844	80.7%	-2.89 [-4.86, -0.92]
Heterogeneity: Tau ² = 2.31; Chi ² = 9.46, df = 5 (P = 0.09); I ² = 47%								
Test for overall effect: Z = 2.88 (P = 0.004)								
1.1.2 Hospital LOS: EDF < 72h and LDF ≥ 72h								
Taylor 2022	11.9	9.34	178	18	12.47	108	19.3%	-6.10 [-8.82, -3.38]
Subtotal (95% CI)			178			108	19.3%	-6.10 [-8.82, -3.38]
Heterogeneity: Not applicable								
Test for overall effect: Z = 4.39 (P < 0.0001)								
Total (95% CI)			1132			952	100.0%	-3.52 [-5.43, -1.62]
Heterogeneity: Tau ² = 2.98; Chi ² = 13.70, df = 6 (P = 0.03); I ² = 56%								
Test for overall effect: Z = 3.62 (P = 0.0003)								
Test for subgroup differences: Chi ² = 3.50, df = 1 (P = 0.06), I ² = 71.5%								

Results

Multi organ failure

Study or Subgroup	EDF Events	EDF Total	LDF Events	LDF Total	Weight	Risk Ratio
1.4.1 Multi-organ failure (MOF)						
Han 2014	7	33	5	39	10.3%	1.65 [0.58, 4.73]
Rojas 2021	0	36	4	82	1.9%	0.25 [0.01, 4.51]
Vallier 2010	3	165	11	253	7.9%	0.42 [0.12, 1.48]
Vallier 2013	2	572	1	433	2.7%	1.51 [0.14, 16.64]
Subtotal (95% CI)		806		807	22.8%	0.86 [0.35, 2.09]
Total events	12		21			
Heterogeneity: Tau ² = 0.18; Chi ² = 3.77, df = 3 (P = 0.29); I ² = 20%						
Test for overall effect: Z = 0.33 (P = 0.74)						

DVT

Study or Subgroup	EDF Events	EDF Total	LDF Events	LDF Total	Weight	Risk Ratio
1.4.2 Deep vein thrombosis (DVT)						
Enninghorst 2010	1	18	2	27	2.8%	0.75 [0.07, 7.67]
Goldstein 1986	2	15	0	18	1.8%	5.94 [0.31, 114.88]
Rojas 2021	2	36	2	82	4.0%	2.28 [0.33, 15.54]
Taylor 2022	3	179	6	108	7.0%	0.30 [0.08, 1.18]
Vallier 2013	40	572	36	433	23.9%	0.84 [0.55, 1.30]
Subtotal (95% CI)		820		668	39.5%	0.84 [0.45, 1.57]
Total events	48		46			
Heterogeneity: Tau ² = 0.12; Chi ² = 4.88, df = 4 (P = 0.30); I ² = 18%						
Test for overall effect: Z = 0.55 (P = 0.58)						

Sepsis

Study or Subgroup	EDF Events	EDF Total	LDF Events	LDF Total	Weight	Risk Ratio
1.4.3 Sepsis						
Han 2014	3	33	2	39	4.8%	1.77 [0.31, 9.98]
Rojas 2021	2	36	4	82	5.2%	1.14 [0.22, 5.94]
Vallier 2013	10	572	23	433	15.9%	0.33 [0.16, 0.68]
Subtotal (95% CI)		641		554	25.9%	0.69 [0.23, 2.13]
Total events	15		29			
Heterogeneity: Tau ² = 0.53; Chi ² = 4.27, df = 2 (P = 0.12); I ² = 53%						
Test for overall effect: Z = 0.64 (P = 0.52)						

Surgical site infection

Study or Subgroup	EDF Events	EDF Total	LDF Events	LDF Total	Weight	Risk Ratio
1.4.4 Surgical site infection						
Enninghorst 2010	0	18	4	27	1.9%	0.16 [0.01, 2.87]
Han 2014	0	33	5	39	1.9%	0.11 [0.01, 1.87]
Vallier 2013	6	572	4	433	8.0%	1.14 [0.32, 4.00]
Subtotal (95% CI)		623		499	11.8%	0.41 [0.08, 2.19]
Total events	6		13			
Heterogeneity: Tau ² = 0.95; Chi ² = 3.41, df = 2 (P = 0.18); I ² = 41%						
Test for overall effect: Z = 1.04 (P = 0.30)						

Discussion

- Clinically and statistically LOS reduction and ARDS are in line with the current body of evidence for management of other lower extremity fractures in polytrauma patients.
- Early definitive fixation is a safe and viable option with no increased risk of complications and mortality.
- The adequacy of resuscitation and estimate of the physiologic reserve should be balanced with surgical burden.
- Further prospective validation studies are required to help stratify patients for early vs late definitive fixation.

References

1. Bone LB, Johnson KD, Weigelt J, et al. Early versus delayed stabilization of femoral fractures. A prospective randomized study. *Bone Joint Surg Am* 1989; 71: 336-40.