Surgical Management of First-Time Patellar Dislocations in Pediatric Patients May Lower Rates of Redislocation Compared to Conservative Management: A Systematic Review and Meta-Analysis

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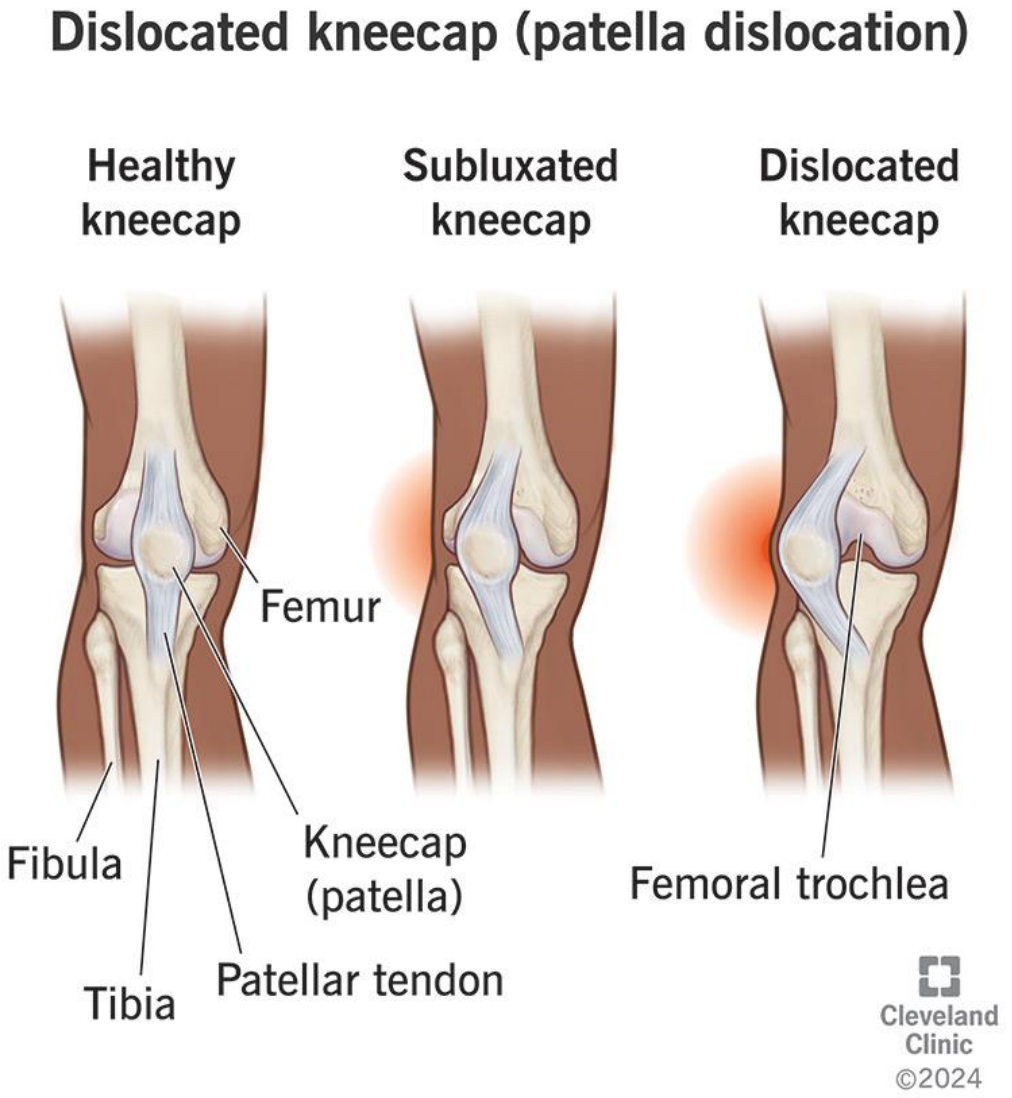
Disclosures

- Olufemi R. Ayeni
  - Speakers Bureau: Stryker Canada
  - Other: Tier 2 Canada Research Chair in Joint Preservation Surgery; President/Owner of Notch Academy

Background

- Patellar dislocations comprise roughly 3% of knee injuries, with most occurring in younger and active patients [9, 18]
- First-time dislocations are often managed conservatively
  - Recurrent instability rates from 35-71% [3, 14, 34]
- Management can be complex in pediatrics as skeletal maturity level can influence the likelihood of recurrent instability [11]
- Pediatric patients tend to have higher recurrence rates and associated complications following patellar dislocation [44]



Dislocated Kneecap (Patella Dislocation) [online] (2025) *Cleveland Clinic*, available: https://my.clevelandclinic.org/health/diseases/21633-patellar-dislocations [accessed 6 Apr 2025].

Purpose

- To assess whether early surgical intervention for first-time patellar dislocations in pediatric patients is superior to conservative management
- We hypothesized that surgical intervention would lead to lower redislocation rates compared to conservative treatment

Methods

- Three online databases (PubMed, MEDLINE, EMBASE) were searched from inception to March 14th, 2024
- Inclusion criteria
  - (1) surgical treatment of first-time patellar dislocations
  - (2) patients under the age of 18
  - (3) level of evidence I-IV
  - (4) clinical and/or functional outcomes reported
  - (5) human studies
  - (6) studies published in English
- Exclusion criteria
  - (1) history of >1 patellar dislocation or recurrent dislocations
  - (2) adult patients
  - (3) textbook chapters
  - (4) conference abstracts
  - (5) biomechanical or cadaveric/animal studies
  - (6) case studies and case series with five or fewer patients

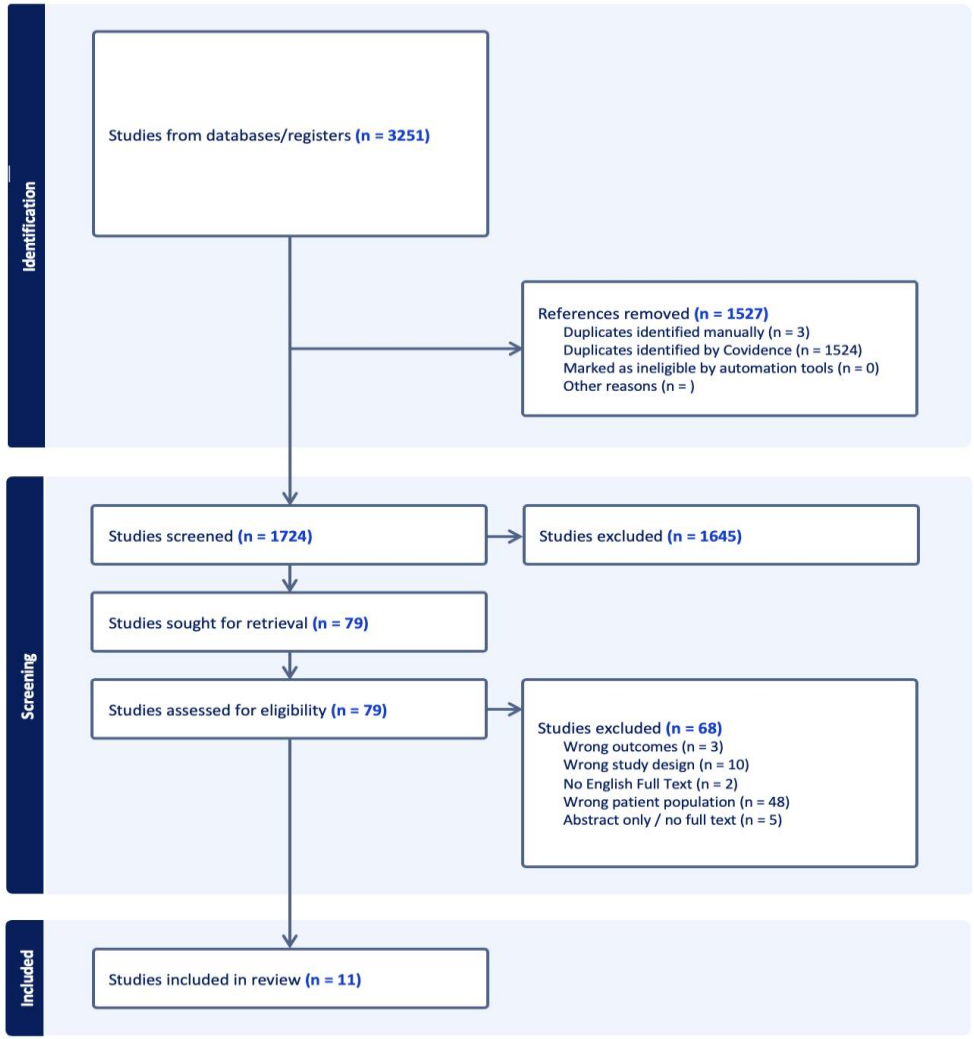


Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) flow diagram representing a systematic review on surgical vs conservative treatment of first-time patellar dislocation in pediatric patients

Results

- 11 studies included:
  - Four (36.4%) Level IV
  - Three (27.3%) Level III
  - Three (27.3%) Level II
  - One (9.1%) Level I
- 673 pediatric patients included
  - Surgical: 334 or
  - Conservative: 339
- Surgical mean age: 13.9 (SD: 0.72)
- Conservative mean age: 13.4 (SD: 0.51)
- Mean follow-up: 53.2 months (SD: 30.3 months, range 12-168)

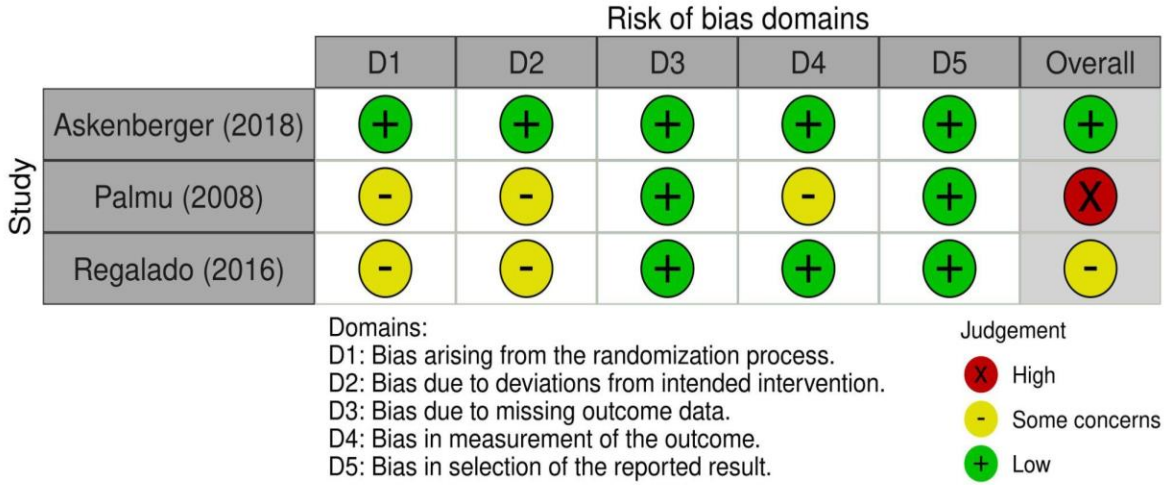


Figure 2. Traffic light plot demonstrating the risk of bias domains for the three randomized controlled trials (RCT) that reported redislocation rates in a systematic review on surgical vs conservative treatment of first-time patellar dislocation in pediatric patients

Results

- Surgical redislocation rate: 25.1% [1, 2, 12, 13, 25, 31, 34–37, 39]
- Conservative redislocation rate: 44.6% [1, 2, 12, 25, 31, 34–36]
- Three meta-analyses on redislocation rates were conducted
    1. All comparative studies
    2. Three RCTs
    3. Two recent RCTs
- Two studies examined MPFL reconstruction [12, 37]
    - MPFLR redislocation rate: 3.1%
    - Non-MPFLR surgical redislocation rate: 39.4%

TABLE 1 Study characteristics and outcomes.

Author (year)	Level of evidence	Mean MINORS score	Treatment group	Sample size	Mean follow-up time (months)	Lost to follow-up (%)	Female (%)	Mean age (years)	Redislocation rate (%)	Mean Kujala score
Apostolovic (2011)	II	72.9	Surgical	14	73.2	0	64.3	13.07	28.6	NR
			Conservative	23			82.6	14.3	17.4	
Askenberger (2018)	I	N/A	Surgical	37	24	0	49	13.2	21.6	90.9
			Conservative	37			54	13.03	43.2	95.9
Gurusamy (2021)	IV	75.0%	Surgical	30	31.2	19	43	14.2	10	92.7
Hartmann (2014)	IV	69.9	Surgical	13	110.7	0	46.2	14.7	0	87.2
Lewallen (2013)	III	71.9	Surgical	24	37.2	5	45.9	14.9	33.3	NR
			Conservative	198					38.4	
Mostrom (2014)	III	83.3	Operated during the acute phase	7	90	0	57.1	12.6	42.9	84
			Conservative	33			48.5	13.5	66.7	84
Palmu (2008)	II	N/A	Surgical	36	72	6	75	13	66.7	83
			Conservative	28			68	13	71.4	84
Pedowitz (2019)	IV	65.6	Surgical	41	49.2	21.1	46	13.8	61	No recurrent instability: 93.9 Recurrent instability: 83
Regalado (2016)	II	N/A	Surgical	16	72	6.7	68.8	13.5	31.2	NR
			Conservative	20		25	55	13.5	55	
Rueth (2023)	III	62.5	Surgical	101	32	10.9	49.5	14.8	0.9	85.3
Seeley (2013)	IV	53.1	Surgical (MPFL repair)	15	11.6	NR	30.4	14.6	20	NR

Abbreviations: MINORS, methodological index for non-randomized studies; MPFL, medial patellofemoral ligament.

Table 1: Study Characteristics and Outcomes

1)

Forest Plot: Redislocations

Study	Surgical	(%)	Conservative	(%)	Weight	RR [95% CI]
Palmu (2008)	24/36	(66.7%)	20/28	(71.4%)	53.0%	0.93 [0.67, 1.3]
Apostolovic (2011)	4/14	(28.6%)	4/23	(17.4%)	3.9%	1.64 [0.49, 5.54]
Lewallen (2013)	8/24	(33.3%)	76/198	(38.4%)	16.3%	0.87 [0.48, 1.57]
Regalado (2016)	5/16	(31.2%)	11/20	(55.0%)	8.4%	0.57 [0.25, 1.3]
Mostrom (2014)	3/7	(42.9%)	22/33	(66.7%)	7.3%	0.64 [0.26, 1.56]
Askenberger (2018)	8/37	(21.6%)	16/37	(43.2%)	11.2%	0.5 [0.24, 1.02]
Pooled Estimate	52/134	(38.8%)	149/339	(44.0%)	I^2: 0%	0.82 [0.65, 1.04]

Mantel-Haenszel, DerSimonian-Laird Random Effects — *p=0.11, z=1.61* — *τ^2=0.00*

RR: Risk Ratio — *CI: Confidence Interval*

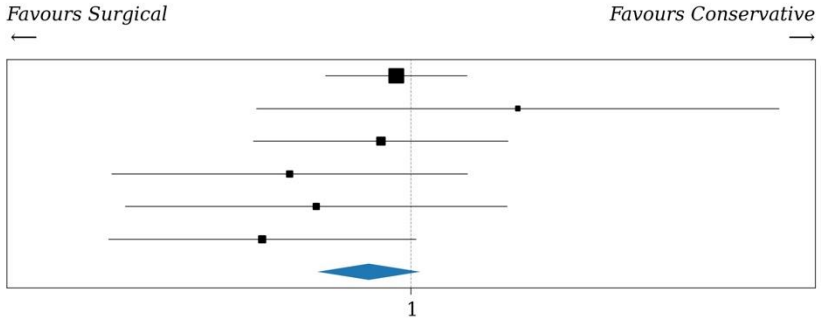


Figure 3. Forest plot (random effects) showing the overall pooled rates of redislocation across the surgical groups compared to the conservative groups with accompanying risk ratio calculations and 95% confidence intervals

2)

Forest Plot: Redislocations

Study	Surgical	(%)	Conservative	(%)	Weight	RR [95% CI]
Palmu (2008)	24/36	(66.7%)	20/28	(71.4%)	51.4%	0.93 [0.67, 1.3]
Regalado (2016)	5/16	(31.2%)	11/20	(55.0%)	22.0%	0.57 [0.25, 1.3]
Askenberger (2018)	8/37	(21.6%)	16/37	(43.2%)	26.6%	0.5 [0.24, 1.02]
Pooled Estimate	37/89	(41.6%)	47/85	(55.3%)	I^2: 47%	0.71 [0.44, 1.14]

Mantel-Haenszel, DerSimonian-Laird Random Effects — *p=0.15, z=1.43* — *τ^2=0.08*

RR: Risk Ratio — *CI: Confidence Interval*

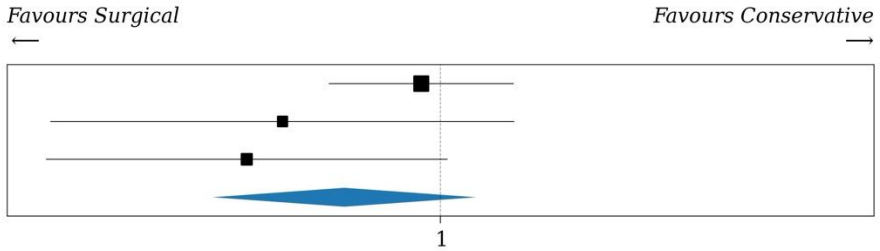


Figure 4. Forest plot (random effects) showing the overall combined rates of redislocation across the surgical groups compared to the conservative groups in the three included RCTs with accompanying risk ratio calculations and 95% confidence intervals

3)

Forest Plot: Redislocations

Study	Surgical	(%)	Conservative	(%)	Weight	RR [95% CI]
Regalado (2016)	5/16	(31.2%)	11/20	(55.0%)	42.8%	0.57 [0.25, 1.3]
Askenberger (2018)	8/37	(21.6%)	16/37	(43.2%)	57.2%	0.5 [0.24, 1.02]
Pooled Estimate	13/53	(24.5%)	27/57	(47.4%)	I^2: 0%	0.53 [0.31, 0.91]

Mantel-Haenszel, DerSimonian-Laird Random Effects — *p=0.02, z=2.31* — *τ^2=0.00*

RR: Risk Ratio — *CI: Confidence Interval*

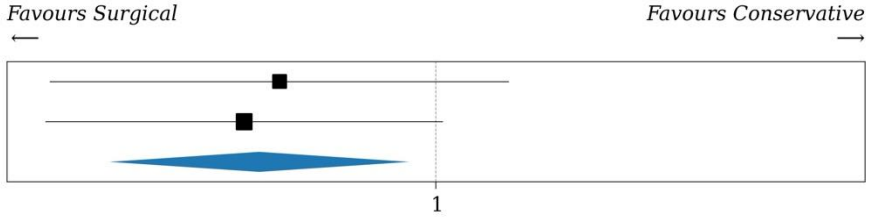


Figure 5. Forest plot (random effects) showing the overall rates of redislocation across the surgical groups compared to the conservative groups in the two recent RCTs, with accompanying risk ratio calculations and 95% confidence intervals

Kujala Scores

- Surgical weighted mean Kujala score: 86.9 (SD: 3.9) [2, 12, 13, 31, 34, 37]
- Conservative weighted mean Kujala score: 88.5 (SD: 6.9) [2, 12, 31, 34]
- One study found a significantly better Kujala score among patients who did not experience recurrent instability (mean (SD): 93.9 (7.2)) than those who did (mean (SD): 83.0 (11.7)) [35]
- No statistically significant difference in mean Kujala score in three comparative studies [2, 31, 34]

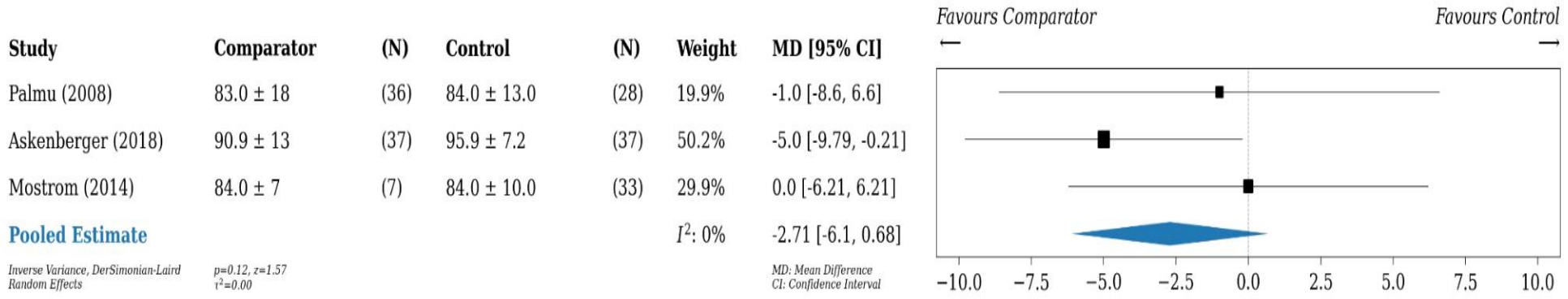


Figure 6. Forest plot (random effects) showing the overall pooled postoperative Kujala score across the surgical groups compared to the conservative groups with accompanying mean difference values and 95% confidence intervals

Complications

- Five studies reported complications categorized as at least a grade II at follow-up [2, 12, 35–37]
- Surgical groups: 7 (2.9%) patients were recorded to have complications [2, 12, 35–37] categorized as III-b [7]
  - Second operation needed to remove implants (n=6, 2.5%) [2, 12, 35, 37]
  - Protrusion of femoral screw requiring surgical revision (n=1, 0.4%)
- Conservative groups: 0 recorded cases of complications categorized higher than a grade I

Clavien-Dindo Classification

Grade	Definition
I	Any deviation from the normal postoperative course without the need for pharmacological treatment or surgical, endoscopic, or radiological interventions Permitted therapeutic regimens are: drugs as antiemetics, antipyretics, analgesics, diuretics, electrolytes, and physiotherapy. The grade also includes wound infections opened at the bedside
II	Requiring pharmacological treatment with drugs other than those permitted for grade I complications Blood transfusions and total parental nutrition are also included
III	Requiring surgical, endoscopic, or radiological intervention
IIIa	Intervention not under general anaesthesia
IIIb	Intervention under general anaesthesia
IV	Life-threatening complication (including complications of the central nervous system)[a] that requires management in a high dependency, or intensive therapy unit
IVa	Single organ dysfunction (including dialysis)
IVb	Multiorgan dysfunction
V	Death
Suffix "d"	If the patient suffers from a complication at the time of discharge the suffix "d" (for "disability") is added to the respective grade of complication. It indicates the need for follow-up to fully evaluate the complication

[a] Brain haemorrhage, ischaemic stroke, subarachnoid bleeding, but excluding transient ischaemic attacks.

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Conclusion

- The primary finding of this review is that early surgical treatment may reduce the risk of redislocation with no statistically significant effect on subjective outcomes or complication rates
- This reduction is most notable in procedures that involve the reconstruction of the MPFL
- Due to the inconsistency of protocols used in both groups, it is difficult to denote a definitive benefit of surgery
- Individual patient factors such as anatomical abnormalities and physeal status should be considered when creating a management plan for these patients

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