

# *Dual versus Single Plate Fixation of Displaced Midshaft Clavicle Fractures: A Cost-Effectiveness Analysis*

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# Disclosures

## Albert Lin has the following affiliations:

- Stryker: Paid Consultant/IP
- Arthrex: Paid Consultant/IP
- American Academy of Orthopedic Surgeons: Committee or board member
- American Shoulder and Elbow Surgeon: Committee or board member
- American Orthopedic Society for Sports Medicine: Committee or board member
- ISAKOS: Committee or board member
- Knee Surgery, Sports Traumatology, Arthroscopy: Editorial or governing board
- Journal of Arthroscopy and Related Surgery: Editorial or governing board
- JISAKOS: Editorial or governing board
- Annals in Joint: Editorial or governing board
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- Journal of American Academy of Orthopedic Surgeons: Reviewer
- Journal of Bone and Joint Surgery: Reviewer
- Journal of Shoulder and Elbow Surgery: Reviewer

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# Background

Prior studies have highlighted lower rates of reoperation with dual plate fixation compared to single plate fixation for displaced midshaft clavicle fractures.

Despite higher upfront costs associated with the dual-plating construct, the observed reduction in secondary operations compared to single-plating may make it a more cost-effective treatment option.

# Study Objective

## Aim:

Assess the cost-effectiveness of dual-plate fixation compared to single-plate fixation in patients with operatively indicated displaced midshaft clavicle fractures

## Hypothesis:

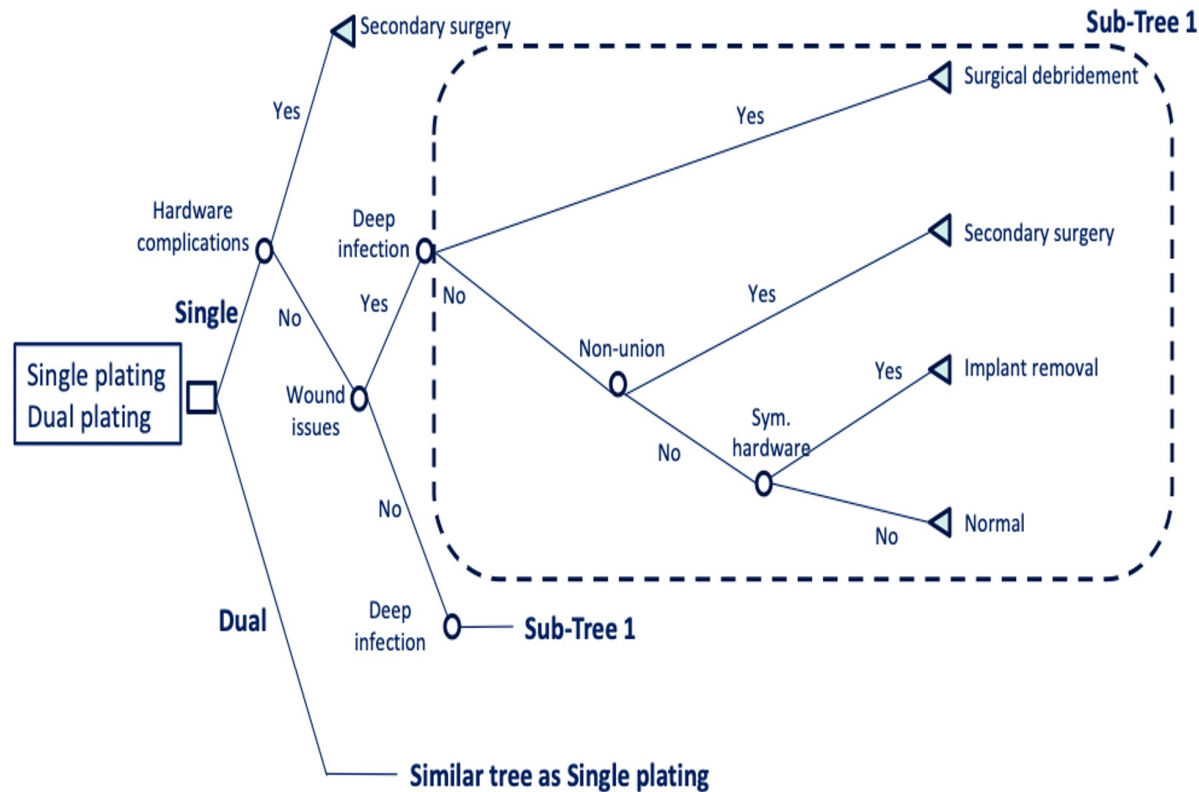
We hypothesized dual-plating would be a more cost-effective surgical option than single-plating, given its lower rates of postoperative complications.

# Study Objective

## Approach:

- ❖ We developed a decision tree (*Figure 1*) to model the occurrence of postoperative complications associated with secondary surgeries.
- ❖ Additionally, the analysis was conducted from the healthcare payer's perspective.
- ❖ We conducted probabilistic and one-way sensitivity analyses.

# Methods – Figure 1



# Study Objective

## Inputs:

Complication-specific risk estimates were pooled for both plating techniques using available literature (Table 1).

## Costs & Benefits:

The costs included direct medical costs, while the benefits were measured in quality-adjusted life-years (QALYs).

# Methods – Table 1

**Table 1.** Complications summary of dual and single plating found in the literature

Study	Dual Plating						Single Plating					
	Patients	Hardware Complications	Wound healing Issues	Deep Infection	Non-union	Symptomatic Hardware	Patients	Hardware Complications	Wound healing Issues	Deep Infection	Non-union	Symptomatic Hardware
Allis 2020 <sup>26</sup>	23	0	0	0	0	0	21	0	0	1	0	5
Charles 2022 <sup>38</sup>	47	0	0	0	0	0	151	1	2	4	5	5
Chen 2017 <sup>45</sup>	34	NA	NA	2	0	2	125	NA	NA	2	6	8
DeBaun 2020 <sup>46</sup>	60	NA	NA	NA	1	5	74	NA	NA	NA	0	15
Lee 2020 <sup>47</sup>	33	0	NA	0	0	NA	89	1	NA	0	2	8
Zhuang 2020 <sup>48</sup>	17	NA	NA	NA	0	0	30	NA	NA	NA	2	NA
Czajka 2020 <sup>29</sup>	81	NA	NA	2	NA	3	These studies did not have a single plating group					
Prasarn 2015 <sup>25</sup>	17	NA	NA	NA	0	1						
Shannon 2016 <sup>49</sup>	13	NA	NA	NA	0	2						
<b>Cumulative</b>	325	0/103 (0.00%)	0/70 (0.00%)	4/218 (1.83%)	1/244 (0.41%)	13/308 (4.22%)	490	2/261 (0.77%)	2/172 (1.16%)	7/386 (1.81%)	15/490 (3.06%)	42/460 (9.13%)



# Results – Table 2

**Table 2:** Base case results

	Single Plating, A	Dual Plating, B	Change = B - A
<u>Secondary surgeries</u> – no. (%)	14.2%	6.4%	7.8% fewer
<u>QALYs</u>	1.673	1.679	0.005
<u>Total costs per patient</u>	\$4,242	\$4,313	\$71
Index surgery	\$3,863	\$4,163	\$300
Secondary surgery	\$373	\$151	(\$223)
Wound healing issues	\$5.8	\$0.0	(\$6)
<b>Incremental cost per QALY gained (ICER) for Dual Plating = \$13,242</b>			

- ❖ The model predicted roughly 8% fewer reoperations in dual plating
- ❖ Dual-plating increased QALYs by 0.005
- ❖ The incremental cost of dual plating was \$71
- ❖ Yielding an incremental cost-effectiveness ratio of \$13,242 per QALY gained

# Results – Figure 2

From the 1-way sensitivity analysis, the most influential parameters were:

- 1) The cost of index surgery
  - 2) Risk of symptomatic hardware
  - 3) Non-union complications in single- and dual-plating
- ❖ Across all parameters, the ICER was always below \$100,000 per QALY gained, suggesting dual plating is a cost-effective strategy within the bounds of model parameters

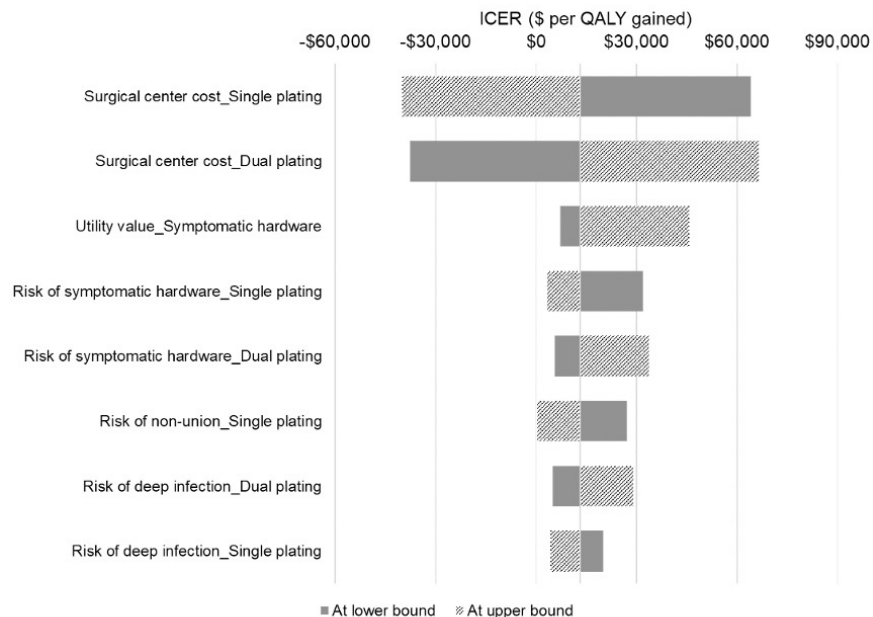


Figure 2: One-way Sensitivity Analysis Results  
The Tornado diagram shows the most sensitive model parameters influencing the cost-effectiveness of dual plating strategy.

# Results – Figure 3

According to results from probabilistic sensitivity analysis:

- ❖ The probability of dual plating being cost-effective exceeded 95% at a WTP threshold of \$100,000 per QALY gained
- ❖ Suggesting that dual plating is a cost-effective strategy.

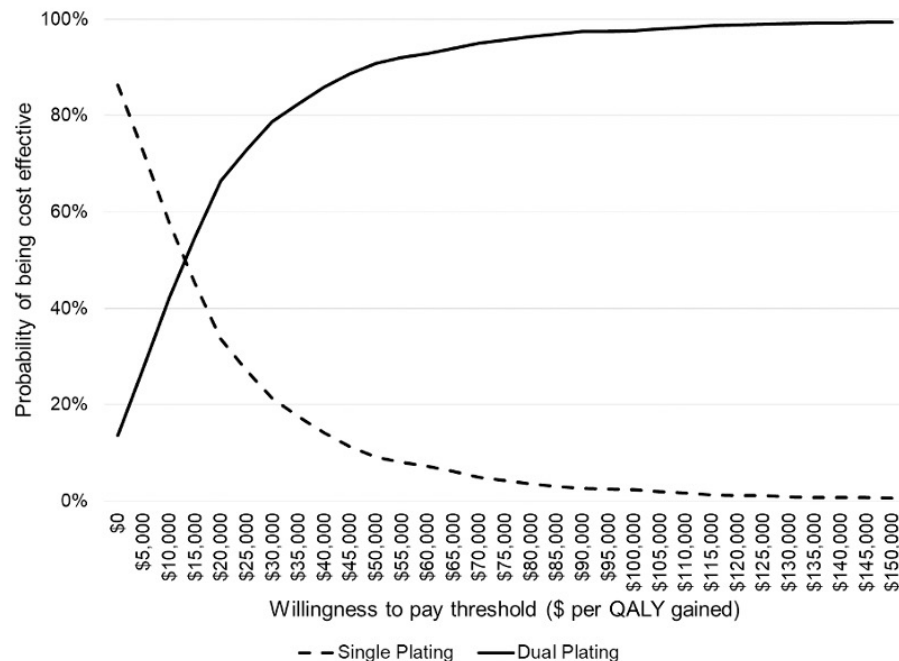


Figure 3: Cost-effectiveness Acceptability Curve

The figure shows how chances of dual plating being cost-effective changes as willingness to pay (WTP) of decision maker changes.

# Discussion

- ❖ Despite its higher initial upfront hardware costs on average of \$300, dual plating appears to offset added costs with greater health benefits via lower rates of reoperation and improved patient quality of life.
- ❖ When indicated, operative management of displaced midshaft clavicle fractures with dual-plating is cost-effective compared to single-plating.

# Clinical Significance

- ❖ Surgeons should consider dual plating as a viable alternative for surgically indicated midshaft clavicle fractures despite its higher upfront cost.

# Thank you



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