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## ***"Debate in chronic infection: 1 or 2 stages"***

Prof. Anders Troelsen



VDI, JANUARY 2022

*Indikation for revision*

	1997-2016		2017		2018		2019		2020		I alt	
	N	%	N	%	N	%	N	%	N	%	N	%
Aseptisk løsning	3952	24.18	207	18.43	252	19.61	207	17.78	221	18.81	4839	22.9
Dyb infektion	2941	17.99	202	17.99	215	16.73	195	16.75	205	17.45	3758	17.8
Knæinstabilitet	2581	15.79	201	17.90	248	19.30	246	21.13	239	20.34	3515	16.7
Smerter uden løsning	2190	13.40	120	10.69	127	9.88	102	8.76	90	7.66	2629	12.5
Andet	1776	10.87	146	13.00	169	13.15	161	13.83	152	12.94	2404	11.4
Polyetylen-svigt	1300	7.95	77	6.86	91	7.08	71	6.10	88	7.49	1627	7.7
Sekundær isættelse af patellakomponent	913	5.59	29	2.58	24	1.87	15	1.29	20	1.70	1001	4.7
2. del af 2-stadie revision	443	2.71	78	6.95	80	6.23	79	6.79	80	6.81	760	3.6
Progression af artrose	248	1.52	63	5.61	79	6.15	88	7.56	80	6.81	558	2.6
I alt	16344	100.00	1123	100.00	1285	100.00	1164	100.00	1175	100.00	21091	100.0

Source: DKR

# The infected TKA - treatments

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## *Treatments for infected TKA:*

- *Irrigation, debridement*
- *One-stage revision*
- *Two-stage revision*
- *Rescue treatments: Arthrodesis, Amputation, Retained spacer*

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RESEARCH ARTICLE

# Re-Infection Outcomes Following One- And Two-Stage Surgical Revision of Infected Knee Prosthesis: A Systematic Review and Meta-Analysis

Setor K. Kunutsor\*, Michael R. Whitehouse, Erik Lenguerrand, Ashley W. Blom, Andrew D. Beswick, INFORM Team<sup>†</sup>

## Review methods

Two independent investigators extracted data and discrepancies were resolved by consensus with a third investigator. Re-infection rates from 10 one-stage studies (423 participants) and 108 two-stage studies (5,129 participants) were meta-analysed using random-effect models after arcsine transformation.

## Results

The rate (95% confidence intervals) of re-infection was 7.6% (3.4–13.1) in one-stage studies. The corresponding re-infection rate for two-stage revision was 8.8% (7.2–10.6). In subgroup analyses, re-infection rates remained generally similar for several study-level and clinically relevant characteristics. Postoperative clinical outcomes of knee scores and range of motion were similar for both revision strategies.

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## Conclusions

Available evidence from aggregate published data suggest the one-stage revision strategy may be as effective as the two-stage revision strategy in treating infected knee prostheses in generally unselected patients. Further investigation is warranted.

Unselected patients ?  
Historical bias !

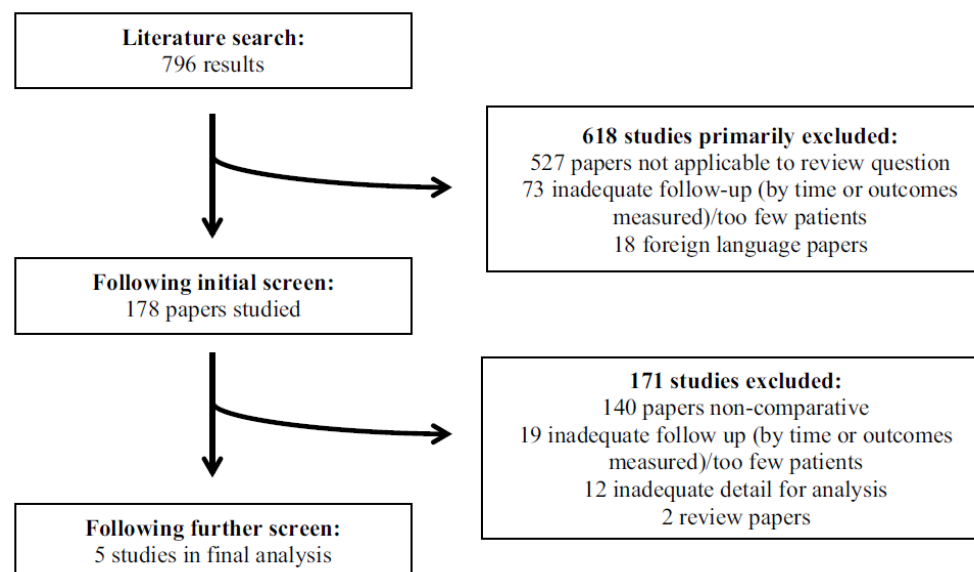
# The infected TKA – One stage revision

Knee Surg Sports Traumatol Arthrosc (2016) 24:3106–3114  
DOI 10.1007/s00167-015-3780-8

KNEE

## One-stage versus two-stage exchange arthroplasty for infected total knee arthroplasty: a systematic review

Navraj S. Nagra<sup>1,2</sup> · Thomas W. Hamilton<sup>2</sup> · Sameer Ganatra<sup>2</sup> · David W. Murray<sup>2</sup> · Hemant Pandit<sup>2</sup>



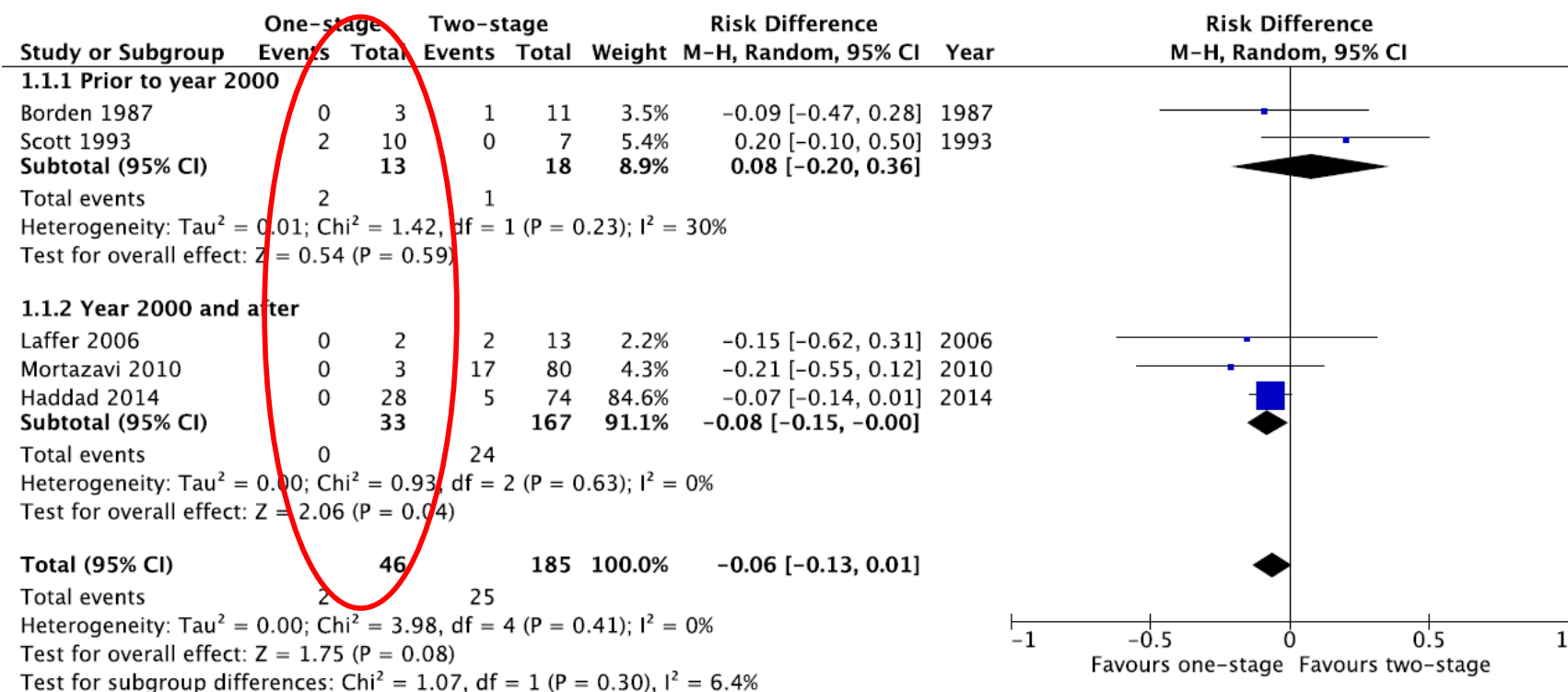
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KNEE

Knee Surg Sports Traumatol Arthrosc (2016) 24:3106–3114

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# The infected TKA – One stage revision

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KNEE

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*Conclusion* Recent studies suggest one-stage exchange arthroplasty may provide superior outcomes, including lower reinfection rates and superior function, in select patients. Clinically, for some patients, one-stage exchange arthroplasty may represent optimum treatment; however, patient selection criteria and key components of surgical and post-operative anti-microbial management remain to be defined.



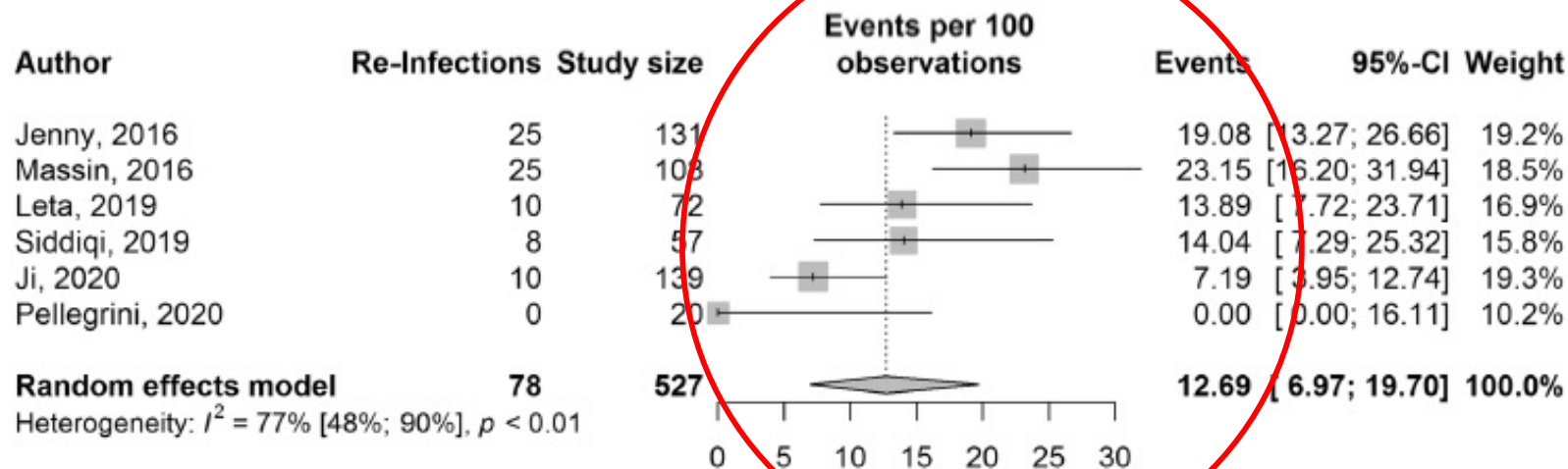


## Reinfection rates after one- and two-stage revision surgery for hip and knee arthroplasty: a systematic review and meta-analysis

Annemarie L. Goud<sup>1</sup> · Netanja I. Harlianto<sup>2</sup> · Solaiman Ezzafzafi<sup>2</sup> · Ewout S. Veltman<sup>2</sup> · Joris E. J. Bekkers<sup>1</sup> · Bart C. H. van der Wal<sup>2</sup>

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**Results** For hip revision arthroplasty, we identified 14 one-stage studies ( $n = 1237$ ) with a pooled reinfection rate of 5.7% (95% CI 3.7–8.1%), and 46 two-stage studies ( $n = 5009$ ) with a reinfection rate of 8.4% (95% CI 6.9–9.9%). For knee revision arthroplasty, 6 one-stage studies ( $n = 527$ ) and 48 two-stage studies ( $n = 4344$ ) were identified with reinfection rates of 12.7% (7.0–19.7%) and 16.2% (13.7–19.0%), respectively. Overall, reinfection rates did not vary substantially after subgroup



**Conclusion** The reinfection rates following one- and two-stage hip and knee arthroplasty revisions were similar. Knee reinfection rates have increased compared to the previous analysis. Individual patient characteristics and adequate treatment algorithms are needed for a more individual selection approach, until a randomized trial is performed.



■ **JOINT ARTHROPLASTY: OPTIMIZING OUTCOMES**  
**Indications for a single-stage exchange  
arthroplasty for chronic prosthetic joint  
infection**

A SYSTEMATIC REVIEW

R. R. Thakrar,  
S. Horriat,  
B. Kayani,  
F. S. Haddad

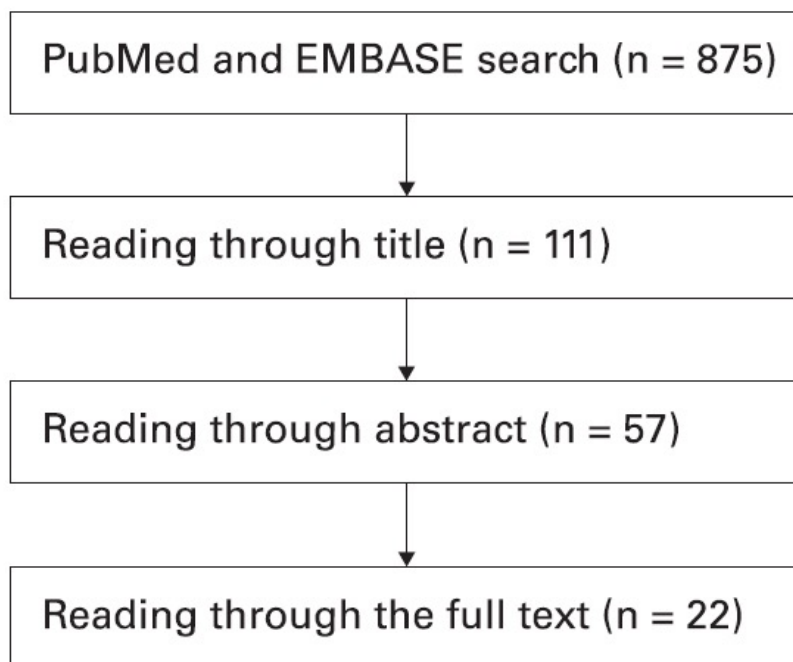


Fig. 1

**Table I.** Details of the studies

Study (year)	Patients included in review, n	Mean follow-up, yrs	Patients with microbiological results, n	Immuno-compromised host	Compromised soft-tissue/bone defect	Reinfection, n (%)	Level of evidence	Revised arthroplasty
Bori et al <sup>24</sup> (2018)	17	3	12	Included	Included	1 (5.8)	IV (Retros)	THA
Lange et al <sup>13</sup> (2017)	56	4	41	Excluded	Excluded	5 (8.9)	IV (Pros)	THA
Born et al <sup>16</sup> (2016)	28	7	27	Included	Excluded	0 (0)	III	THA
Jenny et al <sup>23</sup> (2016)	54 (study group)	3	53	Included	Included	9 (17)	III (Retros)	TKA
Ilchmann et al <sup>22</sup> (2016)	39	6	39	N/A	Excluded sinus/abscess	0 (0)	IV (Retros)	THA
Zahar et al <sup>25</sup> (2016)	70	10	70	Included	Included	5 (7)	IV(Retros)	TKA
Jenny et al <sup>31</sup> (2014)	65	5	62	N/A	N/A	11 (16)	IV (Retros)	THA
Haddad et al <sup>14</sup> (2015)	28	6	28	Excluded	Excluded	0 (0)	III (Retros)	TKA
Tibrewal et al <sup>17</sup> (2014)	50	10	50	Included	Excluded	1 (2)	IV (Retros)	TKA
Zeller et al <sup>18</sup> (2014)	157	3	157	Included	Severe bone defect excluded	8 (5)	IV (Pros)	THA
Klatte et al <sup>19</sup> (2014)	10	7	10 (fungal infection)	Included	Excluded	1 (10)	IV(Retros)	THA/TKA
Klatte et al <sup>29</sup> (2014)	100	3	100	Included	Included	4 (4)	III(Retros)	THA
Bori et al <sup>26</sup> (2014)	24	4	24	Included	Included	1 (4.2)	IV (Retros)	THA
Choi et al <sup>27</sup> (2013)	17	5	15	Included	Included	2 (18)	III (Retros)	THA
Jenny et al <sup>28</sup> (2013)	47	3	47	Included	Included	6 (13)	IV(Retros)	TKA
Klouché et al <sup>20</sup> (2012)	38	3	38	Included	Severe bone defect excluded	0 (0)	III (Pros)	THA
Singer et al <sup>21</sup> (2012)	63	3	63 (excluded MRSA, MRSE)	N/A	Excluded	3 (5)	IV (Retros)	TKA
Oussedik et al <sup>7</sup> (2010)	11	7	11	Excluded	Excluded	0 (0)	IV(Pros)	THA
Rudelli et al <sup>32</sup> (2008)	32	8	29	Excluded	Included	2 (6.2)	IV	THA
Yoo et al <sup>12</sup> (2009)	12	7	12	Excluded	Excluded	1 (8.3)	V (Retros)	THA
Callaghan et al <sup>15</sup> (1999)	24	11	24	Excluded	Severe bone defect excluded	2 (8.3)	IV	THA
Ure et al <sup>30</sup> (1998)	20	9.9	20	N/A	Included	0 (0)	IV(Pros)	THA

Retros, retrospective; Pros, prospective; THA, total hip arthroplasty; TKA, total knee arthroplasty; N/A, not available; MRSA, methicillin-resistant *Staphylococcus aureus*; MRSE, methicillin-resistant *Staphylococcus epidermidis*





## ■ JOINT ARTHROPLASTY: OPTIMIZING OUTCOMES

### Indications for a single-stage exchange arthroplasty for chronic prosthetic joint infection

A SYSTEMATIC REVIEW

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ed that single-stage exchange arthroplasty be undertaken in the absence of the following features: severe immunosuppression with or without significant systemic disease; concurrent acute local sepsis and soft-tissue or bony compromise not amenable to primary wound closure; and multidrug resistant, polymicrobial or atypical organisms. The lack of preoperatively identified infective organisms seems to represent a relative contraindication to this procedure.

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**Authors:** Peter Keogh, Andrew Toms, Akos Zahar, Fares Haddad, Shengjie Guo, S. McHale

**QUESTION 2:** What are the indications and contraindications for a one-stage exchange arthroplasty for the treatment of chronic periprosthetic joint infections (PJIs)?

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**RECOMMENDATION:** One-stage exchange arthroplasty remains a viable option for the management of chronic PJIs. In patients with signs of systemic sepsis, extensive comorbidities, infection with resistant organisms, culture-negative infections and poor soft tissue coverage, one-stage exchange arthroplasty may not be a good option.

**LEVEL OF EVIDENCE:** Moderate

**DELEGATE VOTE:** Agree: 93%, Disagree: 5%, Abstain: 2% (Super Majority, Strong Consensus)

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## Indications for One-stage

### Host/Local

- Non-immunocompromised host
- Absence of systemic sepsis
- Minimal bone loss/soft tissue defect allowing primary wound closure
- Microbiology
- Isolation of pathogenic organism preoperatively
- Known sensitivities to bactericidal treatment

### Relative Contraindication to One-stage

- Severe damage of soft tissues where the direct closure of the joint and the wound is not possible. A complex sinus tract which cannot be excised along with the old scar.
- Culture-negative PJI, where the causative organism and its susceptibility are not known.
- No radical debridement of infected soft tissues or bone is possible (for whatever reason).
- No local antimicrobial treatment is possible (for whatever reason).
- No proper bone stock exists for the fixation of the new implant.

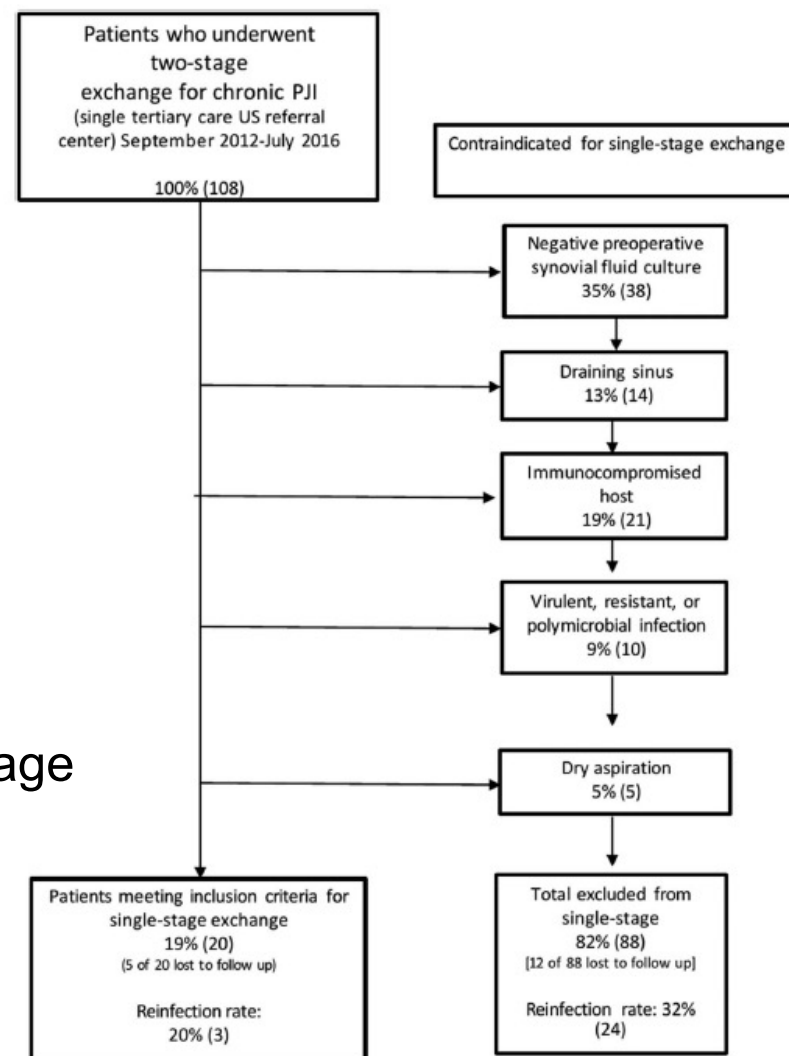


**Selected Proceedings from the 2019 Musculoskeletal Infection Society Meeting**  
(Guest Editor Charalampos G. Zalavras MD, PhD)

## A Low Percentage of Patients Satisfy Typical Indications for Single-stage Exchange Arthroplasty for Chronic Periprosthetic Joint Infection

M. E. Dombrowski MD, A. E. Wilson MD, R. A. Wawrose MD, M. J. O'Malley MD,  
K. L. Urish MD, B. A. Klatt MD

- 19 % of chronic PJI were eligible for 1-stage
- Re-infection rate of 20 %



# Conclusions

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- 2-stage is the workhorse of PJI treatment
- 1-stage is a viable solution
- Few patients treated in low number of studies
- Strict selection seems warranted (1 in 5 is a candidate?)
- Efficacy compared with 2-stage is unelucidated