

Supplementary data

Table 1. Summary of included studies

Study	Country	Arm used as control in our analysis	Treatment arm of interest	Route of steroid delivery	Steroid dosage (prednisolone equivalent)	Time of steroid delivery
Chia et al. 2013	Australia	100 mL of 0.2% ropivacaine (n = 40)	Arm 1: Control plus 40 mg triamcinolone acetate (n = 39) Arm 2: Control plus 80 mg triamcinolone acetate (n = 40)	Periarticular injection	Arm 1: 50 mg Arm 2: 100 mg	Intraoperatively
Christensen et al. 2009	USA	80 mg bupivacaine hydrochloride, 4 mg morphine, 300 µg epinephrine, 100 µg clonidine, 750 mg cefuroxime, normal saline (n = 37)	40 mg methyl-prednisolone plus control (n = 39)	Periarticular injection	50 mg	Intraoperatively
Ikeuchi et al. 2014	Japan	20 mL of 0.75% ropivacaine, 400 mg isepamicin (n = 20) Saline (n = 15)	6.6 mg dexamethasone plus control (n = 20)	Periarticular injection	8.3 mg	Intraoperatively
Jules-Elysee et al. 2011	USA	Saline (n = 17)	200 mg hydrocortisone (n = 15)	Intravenously	50 mg	2 h preoperatively
Jules-Elysee et al. 2012	USA	Saline (n = 17)	300 mg hydrocortisone (n = 17)	Intravenously	75 mg	2 h preoperatively
Kim et al. 2015	Korea	180 mg ropivacaine, 5 mg morphine, 30 mg ketorolac (n = 45)	40 mg methyl-prednisolone plus control arm of interest (n = 45)	Intravenously	40 mg	Intraoperatively
Koh et al. 2013	Korea	0.3 mg ramosetron (n = 134)	10 mg dexamethasone plus control (n = 135)	Intravenously	62.5 mg	Intraoperatively
Lunn et al. 2011	Denmark	2 mL isotonic saline (n = 24)	125 mg methyl-prednisolone (n = 24)	Intravenously	156 mg	Preoperatively in the anaesthetic room
Ng et al. 2011	Singapore	0.5 mL/kg of 0.5% bupivacaine/1:200,000 in 30 mL saline (n = 42)	50 mg prednisolone dose equivalent of triamcinolone acetate plus control (n=41)	Periarticular injection	50 mg	Intraoperatively
Pang et al. 2008	Singapore	0.5mL/kg of 1:200,000 epinephrine and 0.5% bupivacaine in 30 mL normal saline (n = 45)	40 mg triamcinolone acetate plus control (n = 45)	Periarticular injection	50 mg	Intraoperatively
Seah et al. 2011	Singapore	0.5% bupivacaine and with epinephrine 1:200,000 (n = 50)	40 mg triamcinolone acetate (n = 50)	Periarticular injection	50 mg	Intraoperatively
Tammachote et al. 2016	Thailand	Normal saline (n=40)	0.15 mg/kg dexamethasone (n = 40)	Intravenous	50 mg	Just before surgery
Tsduka et al. 2016	Japan	40 mL of 7.5 mg/mL ropivacaine, 0.8 mL of 10 mg/mL morphine hydrochloride hydrate, 0.3 mL of 1 mg/mL epinephrine, 50 mg ketoprofen and normal saline.	40mg methyl-prednisolone plus control	Periarticular injection	50 mg	Intraoperatively
Yue et al. 2013	China	15 mL 0.75% ropivacaine 0.25 mL 1:1000 adrenaline, 35 mL isotonic sodium chloride (n = 36)	1 ml beta-methasone plus control (n = 36)	Periarticular injection	1 mL beta-methasone (No dosage stated)	Intraoperatively

Table 2. Results of studies which could not be included in meta-analysis. Type of surgery was arthroplasty in all

Outcome/Study	Control group outcome	Steroid group outcome
Pain 24 hours		
Kim et al. 2015	Mean VAS (10 cm) = 3.52	Mean VAS (10 cm) = 3.41
Lunn et al. 2011	Median VAS (100 mm) = 45.6 (IQ 45.8)	Median VAS (100 mm) = 19.1 (IQ 20.4)
Seah et al. 2011	Mean VAS (10 cm) = 1.46	Mean VAS (10 cm) = 1.24
Yue et al. 2013	Mean VAS (10 cm) = 6.36	Mean VAS (10 cm) = 6.09
Pain 12 hours		
Kim et al. 2015	Mean VAS (10 cm) = 3.46	Mean VAS (10 cm) = 3.38
Seah et al. 2011	Mean VAS (10 cm) = 1.83	Mean VAS (10 cm) = 1.51
Yue et al. 2013	Mean VAS (10 cm) = 5.4	Mean VAS (10 cm) = 5.5
Pain 48 hours		
Kim et al. 2015	Mean VAS (10 cm) = 3.31	Mean VAS (10 cm) = 3.15
Lunn et al. 2011	Median VAS (100 mm) = 10.4 (IQ 4.18)	Median VAS (100 mm) = 5.66 (IQ 21.8)
Yue et al. 2013	Mean VAS (10 cm) = 3.6	Mean VAS (10 cm) = 3.4
PONV 24 hours postoperatively		
Koh et al. 2013	0–6 hours – 49/134 cases 6–24 hours – 33/134 cases	0–6 hours – 29/135 cases 6–24 hours – 26/135 cases
Opiate consumption 24 hours postoperatively		
Lunn et al. 2011	Median 19.9 mg (IQ 18.7) oxycodone	Median 10 mg (IQ 14.6) oxycodone
Seah et al. 2011	Mean 1.29 mg/h i.v. morphine	Mean 0.89 mg/h i.v. morphine
Yue et al. 2013	Mean 13.4 mg i.v. morphine	Mean 13.2 mg i.v. morphine
Time till discharge		
Lunn et al. 2011	Mean 4.7 days (range 2.9–6)	Mean 3.7 days (range 2.6–4.8)
Seah et al. 2011	Mean 6.8 days	Mean 5.2 days

PONV – Postoperative nausea and vomiting



Figure 2. Assessment of risk of bias in included studies.

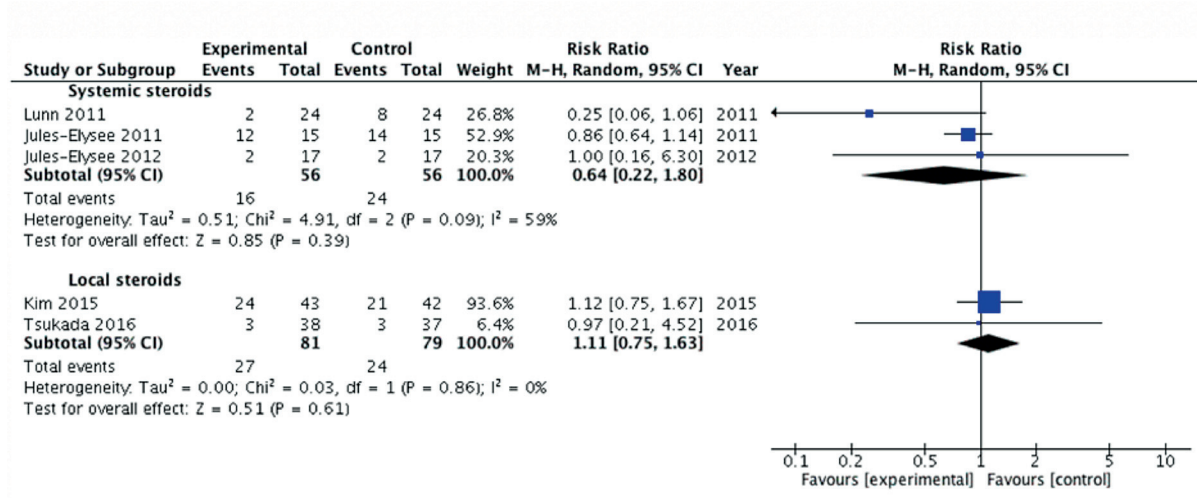


Figure 4. PONV 24 hours postoperatively.

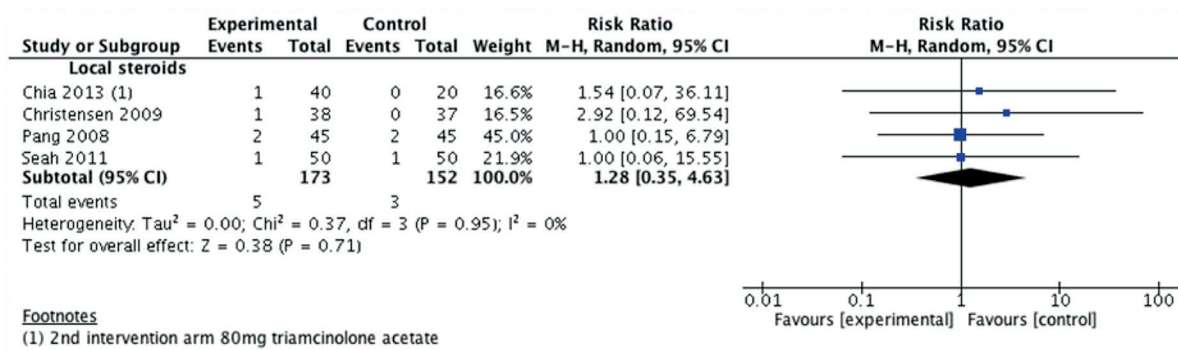


Figure 5. Infection rates during study.

Appendix

Literature search strategy

Search E1. Ovid Medline search strategy

- 1 Steroids/ or HYDROCORTISONE/ or BETAMETHASONE/ or Prednisolone/ or Dexamethasone/ or Triamcinolone/ or Cortisone/ or Glucocorticoids/ or Adrenal-Cortex-Hormones/ or Corticosterone/ or Hydrocortisone/ or 18-Hydroxycorticosterone/ or Tetrahydrocortisol/ or Tetrahydrocortisone/ or Desoxycorticosterone/ or 18-Hydroxydesoxycorticosterone/
- 2 (“adrenal cortex hormon\$” or steroid\$ or corticosterone or corticosteroid\$ or cortisol\$ or hydrocortisone\$ or 18-hydroxycorticosterone or cortison\$ or tetrahydrocortisol or hydrocortison\$ or betamethason\$ or prednisolon\$ or methylprednisolon\$ or dexamethason\$ or triamcinolon\$ or deflazacort\$).ti,ab.
- 3 1 or 2
- 4 Surgical Procedures, Operative/ or Surgery/ or Perioperative-Care/
- 5 (surg\$ or operat\$ or (perioperative adj3 care)).mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]
- 6 4 or 5
- 7 Pain, Postoperative/
- 8 ((postoperative adj4 pain*) or (post-operative adj4 pain*) or post-operative-pain* or (post* adj4 pain*) or (postoperative adj4 analgesi*) or (post-operative adj4 analgesi*) or “post-operative analgesi*”).mp.
- 9 ((post-surgical adj4 pain*) or (“post surgical” adj4 pain*) or (post-surgery adj4 pain*)).mp.
- 10 (“pain-relief after surg*” or “pain following surg*” or “pain control after”).mp.
- 11 (“post surg*” or post-surg*) and (pain* or discomfort)).mp.
- 12 ((pain* adj4 “after surg*”) or (pain* adj4 “after operat*”) or (pain* adj4 “follow* operat*”) or (pain* adj4 “follow* surg*”).mp.
- 13 ((analgesi* adj4 “after surg*”) or (analgesi* adj4 “after operat*”) or (analgesi* adj4 “follow* operat*”) or (analgesi* adj4 “follow* surg*”).mp.
- 14 7 or 8 or 9 or 10 or 11 or 12 or 13
- 15 (randomized controlled trial or controlled clinical trial).pt. or randomized.ab. or placebo.ab. or clinical trials as topic. sh. or randomly.ab. or trial.ti.
- 16 3 and 6 and 14 and 15

Search E2. EMBASE search strategy

- 1 teroid/ or hydrocortisone/ or betamethasone/ or prednisolone/ or dexamethasone/ or triamcinolone/ or cortisone/ or glucocorticoid/ or corticosterone/ or hydrocortisone/ or 18-hydroxycorticosterone/ or tetrahydrocortisol/ or tetrahydrocortisone/ or deoxycorticosterone/ or 18-hydroxydesoxycorticosterone/
- 2 (adrenal cortex hormon\$ or steroid\$ or corticosterone or corticosteroid\$ or cortisol\$ or hydrocortisone\$ or 18-hydroxycorticosterone or cortison\$ or tetrahydrocortisol or hydrocortison\$ or betamethason\$ or prednisolon\$ or methylprednisolon\$ or dexamethason\$ or triamcinolon\$ or deflazacort\$).ti,ab.
- 3 1 or 2
- 4 surgical-technique/ or surgery/ or perioperative-period/ or (surg\$ or operat\$ or (perioperative adj3 care)).ti,ab.
- 5 Pain, Postoperative/
- 6 ((postoperative adj4 pain*) or (post-operative adj4 pain*) or post-operative-pain* or (post* adj4 pain*) or (postoperative adj4 analgesi*) or (post-operative adj4 analgesi*) or “post-operative analgesi*”).mp.
- 7 ((post-surgical adj4 pain*) or (“post surgical” adj4 pain*) or (post-surgery adj4 pain*)).mp.
- 8 (“pain-relief after surg*” or “pain following surg*” or “pain control after”).mp.
- 9 (“post surg*” or post-surg*) and (pain* or discomfort)).mp.
- 10 ((pain* adj4 “after surg*”) or (pain* adj4 “after operat*”) or (pain* adj4 “follow* operat*”) or (pain* adj4 “follow* surg*”).mp.
- 11 ((analgesi* adj4 “after surg*”) or (analgesi* adj4 “after operat*”) or (analgesi* adj4 “follow* operat*”) or (analgesi* adj4 “follow* surg*”).mp.
- 12 5 or 6 or 7 or 8 or 9 or 10 or 11
- 13 3 and 4 and 12
- 14 (placebo.sh. or controlled study.ab. or random*.ti,ab. or trial*.ti,ab.) and human*.ec,hw,fs.
- 15 13 and 14
- 16 1 or 2
- 17 4 and 12 and 14 and 16

Search E3 CENTRAL search strategy

ID	Search	Hits
#1	MeSH descriptor: [Steroids] explode all trees	
#2	MeSH descriptor: [Hydrocortisone] explode all trees	
#3	MeSH descriptor: [Betamethasone] explode all trees	
#4	MeSH descriptor: [Prednisolone] explode all trees	
#5	MeSH descriptor: [Dexamethasone] explode all trees	
#6	MeSH descriptor: [Triamcinolone] explode all trees	
#7	MeSH descriptor: [Cortisone] explode all trees	
#8	MeSH descriptor: [Glucocorticoids] explode all trees	
#9	MeSH descriptor: [Adrenal Cortex Hormones] explode all trees	
#10	MeSH descriptor: [Corticosterone] explode all trees	
#11	MeSH descriptor: [Hydrocortisone] explode all trees	
#12	MeSH descriptor: [18-Hydroxycorticosterone] explode all trees	
#13	MeSH descriptor: [Tetrahydrocortisol] explode all trees	
#14	MeSH descriptor: [Tetrahydrocortisone] explode all trees	
#15	MeSH descriptor: [Desoxycorticosterone] explode all trees	
#16	MeSH descriptor: [18-Hydroxydesoxycorticosterone] explode all trees	
#17	(adrenal cortex hormon* or steroid* or corticosterone or corticosteroid* or cortisol* or hydrocortisone* or 18-hydroxycorticosterone or cortison* or tetrahydrocortisol or hydrocortison* or betamethason* or prednisolon* or methylprednisolon* or dexamethason* or triamcinolon* or deflazacort*)	
#18	(#1 or #2 or #3 or #4 or #5 or #6 or #7 or #8 or #9 or #10 or #11 or #12 or #13 or #14 or #15 or #16 or #17)	
#19	MeSH descriptor: [Surgical Procedures, Operative] explode all trees	
#20	MeSH descriptor: [General Surgery] explode all trees	
#21	MeSH descriptor: [Perioperative Care] explode all trees	
#22	(surg* or operat* or (perioperative near care)):ti,ab	
#23	(#19 or #20 or #21 or #22)	
#24	MeSH descriptor: [Pain, Postoperative] explode all trees	
#25	((postoperative near/4 pain*) or (post-operative near/4 pain*) or post-operative-pain* or (post* near/4 pain*) or (postoperative near/4 analgesi*) or (post-operative near/4 analgesi*) or (“post-operative analgesi*”)):ti,ab,kw	
#26	((post-surgical near/4 pain*) or (“post surgical” near/4 pain*) or (post-surgery near/4 pain*)):ti,ab,kw	
#27	(“pain-relief after surg*” or “pain following surg*” or “pain control after”):ti,ab,kw	
#28	(“post surg*” or post-surg*) and (pain* or discomfort):ti,ab,kw	
#29	((pain* near/4 “after surg*”) or (pain* near/4 “after operat*”) or (pain* near/4 “follow* operat*”) or (pain* near/4 “follow* surg*”)):ti,ab,kw	
#30	((analgesi* near/4 “after surg*”) or (analgesi* near/4 “after operat*”) or (analgesi* near/4 “follow* operat*”) or (analgesi* near/4 “follow* surg*”)):ti,ab,kw	
#31	#24 or #25 or #26 or #27 or #28 or #29 or #30	
#32	#18 and #23 and #31	

Supplementary Figures E1–E6

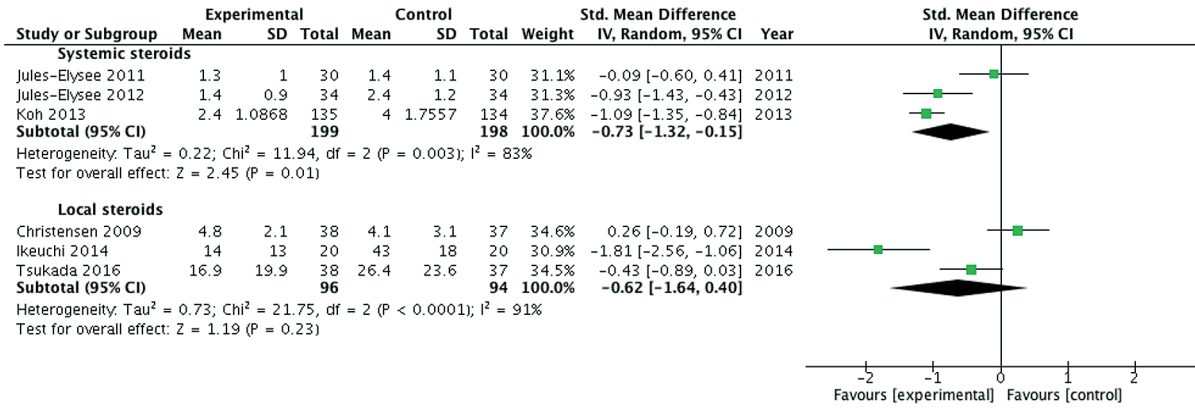


Figure E1. Pain scores at 24 hours postoperatively including the Christensen et al. 2009 study.

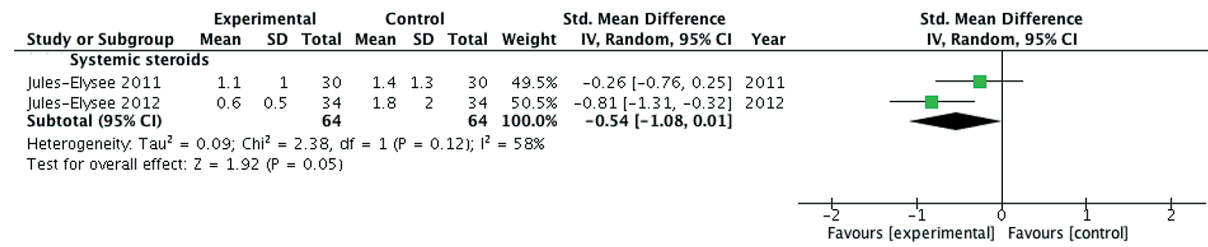


Figure E2. Pain scores at 12 hours postoperatively.

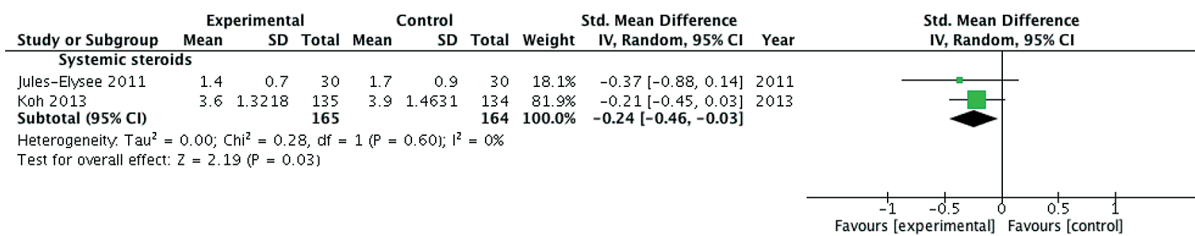


Figure E3. Pain scores at 48 hours postoperatively.

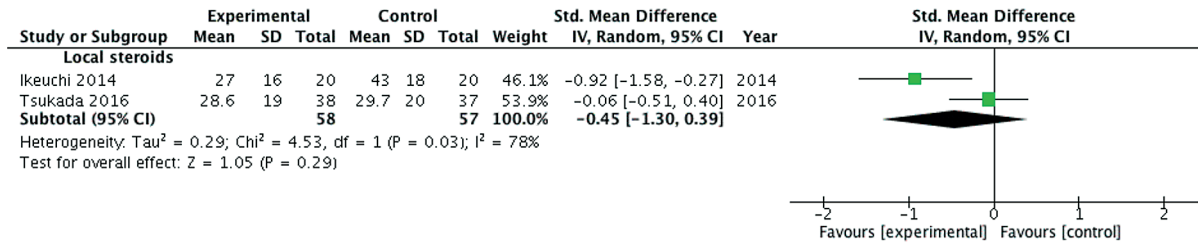


Figure E4. Pain scores at 72 hours postoperatively.

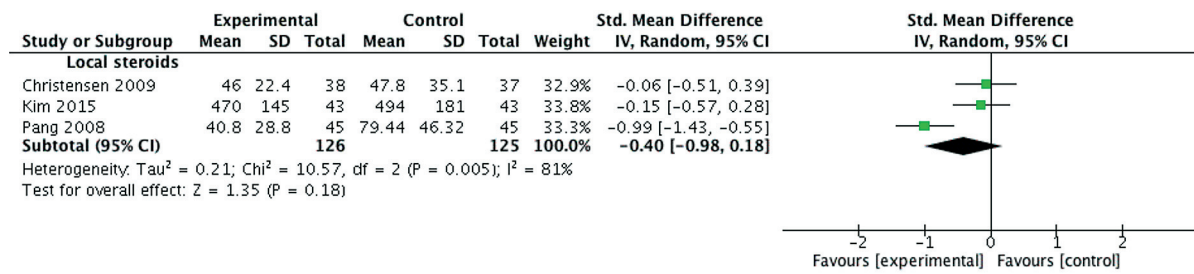


Figure E5. Opiate consumption (intravenous morphine equivalents) in first 24 hours post operatively.

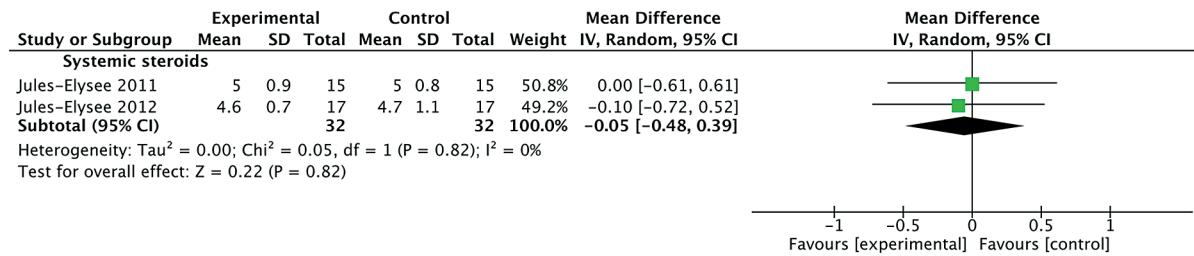


Figure E6. Mean time till discharge (days).