Supplementary table 3

Details of the risk of bias assessment

Risk of bias assessment of cross-sectional studies

The Appraisal Tool for Cross-Sectional Studies (AXIS tool) comprises 20 items in 5 domains, evaluating various aspects of methodological quality (Downes MJ, Brennan ML, Williams HC, Dean RS. Development of a critical appraisal tool to assess the quality of crosssectional studies (AXIS). BMJ Open 2016;6:e011458). Each item has three rating options: "Yes" - met the description of a particular evaluation criterion, "No" - did not meet a particular criterion or "Don't know" - insufficient information to evaluate a particular criterion.

Risk of bias questions (AXIS)

Introduction

1. Were the aims/objectives of the study clear?

Methods

2. Was the study design appropriate for the stated aim(s)?
3. Was the sample size justified?
4. Was the target/reference population clearly defined? (Is it clear who the research was about?)
5. Was the sample frame taken from an appropriate population base so that it closely represented the target/reference population under investigation?
6. Was the selection process likely to select subjects/participants that were representative of the target/reference population under investigation?
7. Were measures undertaken to address and categorise non-responders?
8. Were the risk factor and outcome variables measured appropriate to the aims of the study?
9. Were the risk factor and outcome variables measured correctly using instruments/measurements that had been trialled, piloted or published previously?
10. Is it clear what was used to determined statistical significance and/or precision estimates? (e.g. p-values, confidence intervals)
11. Were the methods (including statistical methods) sufficiently described to enable them to be repeated?

Results

12. Were the basic data adequately described?

13. Does the response rate raise concerns about non-response bias?
14. If appropriate, was information about non-responders described?
15. Were the results internally consistent?
16. Were the results presented for all the analyses described in the methods?

Discussion

17. Were the authors' discussions and conclusions justified by the results?
18. Were the limitations of the study discussed?

Other

19. Were there any funding sources or conflicts of interest that may affect the authors' interpretation of the results?
20. Was ethical approval or consent of participants attained?

Table. Risk of bias assessment of cross-sectional studies (AXIS tool)

Author, year	Introduction	Methods										Results					Discussion		Other	
	1	2	3	4	5	6	7	8	9	10	11	12	13*	14	15	16	17	18	19*	20
Balint et al., 2002	Y	Y	N [1]	Y	DK [2]	DK [2]	Y	Y	Y	Y	Y	Y	N	N/A [3]	Y	Y	Y	N [4]	NI [5]	NI [6]
Chang et al., 2015	N [7]	N [7]	N [8]	Y	DK [2]	DK [2]	N/A [3]	N [7]	DK [9]	Y	Y	N [10]	N/A [3]	N/A [3]	Y	Y	N [11]	Y	NI [5]	Y
Bossert et al., 2016	Y	Y	N [12]	Y	DK [2]	DK [2]	Y	Y	DK [13]	Y	Y	Y	N	N/A [3]	Y	Y	Y	Y	NI [5]	Y
Resnick et al., 2017	N [14]	Y	N [1]	Y	N [15]	N [15]	Y	Y	Y	Y	Y	Y	N	N [16]	Y	Y	Y	Y	NI [5]	Y

Y=yes; N=no; DK= don't know; NI= no information; N/A=not applicable;*Item is reverse scored (i.e., no is a positive) [1]no information on sample size; [2]no information why exactly these patients were chosen; [3]not applicable for this study design; [4]limitations of the study are not discussed; [5]no information on funding; [6]no information on ethical approval or consent of participants; [7]aims/objectives/methods of the study are not clear; [8]no information why Authors has chosen the period 2002-2011; [9]scarce information on the reference and index test; [10]baseline data for each group are missing; [11]discussions and conclusions seem not be justified by the results; [12]no information about the reason of the patients number; [13]questionable whether "how strong was your severe impairment" is actually a validated tool; [14]not clear imaging procedures used in the image-guided group; [15]several subtypes of JIA; [16]information about non-responders are not described.

Risk of bias assessment of non-randomised studies

The Risk Of Bias In Non-randomised Studies - of Interventions tool (ROBINS-I tool) comprises 34 items in 7 domains, evaluating various aspects of methodological quality (Sterne JAC et al, ROBINS-I: a tool for assessing risk of bias in non-randomised studies of interventions. BMJ 2016;355:i4919). Each domain has five rating options: “Low risk of bias” - the study is comparable to a well performed randomised trial; “Moderate risk of bias” - the study provides sound evidence for a non-randomised study but cannot be considered comparable to a well performed randomised trial; “Serious risk of bias” - the study has some important problems; “Critical risk of bias” - the study is too problematic to provide any useful evidence and should not be included in any synthesis; “No information” - No information on which to base a judgement about risk of bias.

Risk of bias questions (ROBINS-I)

Bias due to confounding

1.1 Is there potential for confounding of the effect of intervention in this study?

If N/PN to 1.1: the study can be considered to be at low risk of bias due to confounding and no further signalling questions need be considered.

If Y/PY to 1.1: determine whether there is a need to assess time-varying confounding: 1.2. Was the analysis based on splitting participants’ follow up time according to intervention received?

If N/PN, answer questions relating to baseline confounding (1.4 to 1.6)

If Y/PY, proceed to question 1.3.

1.3. Were intervention discontinuations or switches likely to be related to factors that are prognostic for the outcome?

If N/PN, answer questions relating to baseline confounding (1.4 to 1.6)

If Y/PY, answer questions relating to both baseline and time-varying confounding (1.7 and 1.8)

1.4. Did the authors use an appropriate analysis method that controlled for all the important confounding domains?

1.5. If Y/PY to 1.4: Were confounding domains that were controlled for measured validly and reliably by the variables available in this study?

1.6. Did the authors control for any post-intervention variables that could have been affected by the intervention?

1.7. Did the authors use an appropriate analysis method that adjusted for all the important confounding domains and for timevarying confounding?

1.8. If Y/PY to 1.7: Were confounding domains that were adjusted for measured validly and reliably by the variables available in this study?
Optional: What is the predicted direction of bias due to confounding?

Bias in selection of participants into the study

2.1. Was selection of participants into the study (or into the analysis) based on participant characteristics observed after the start of intervention? If N/PN to 2.1: go to 2.4
2.2. If Y/PY to 2.1: Were the postintervention variables that influenced selection likely to be associated with intervention?
2.3 If Y/PY to 2.2: Were the postintervention variables that influenced selection likely to be influenced by the outcome or a cause of the outcome?
2.4. Do start of follow-up and start of intervention coincide for most participants?
2.5. If Y/PY to 2.2 and 2.3, or N/PN to 2.4: Were adjustment techniques used that are likely to correct for the presence of selection biases?
Optional: What is the predicted direction of bias due to selection of participants into the study?

Bias in classification of interventions

3.1 Were intervention groups clearly defined?
3.2 Was the information used to define intervention groups recorded at the start of the intervention?
3.3 Could classification of intervention status have been affected by knowledge of the outcome or risk of the outcome?
Optional: What is the predicted direction of bias due to measurement of outcomes or interventions?

Bias due to deviations from intended interventions

4.1. Were there deviations from the intended intervention beyond what would be expected in usual practice?
4.2. If Y/PY to 4.1: Were these deviations from intended intervention unbalanced between groups and likely to have affected the outcome?
4.3. Were important co-interventions balanced across intervention groups?
4.4. Was the intervention implemented successfully for most participants?
4.5. Did study participants adhere to the assigned intervention regimen?
4.6. If N/PN to 4.3, 4.4 or 4.5: Was an appropriate analysis used to estimate the effect of starting and adhering to the intervention?

Optional: What is the predicted direction of bias due to deviations from the intended interventions?

Bias due to missing data

5.1 Were outcome data available for all, or nearly all, participants?

5.2 Were participants excluded due to missing data on intervention status?

5.3 Were participants excluded due to missing data on other variables needed for the analysis?

5.4 If PN/N to 5.1, or Y/PY to 5.2 or 5.3: Are the proportion of participants and reasons for missing data similar across interventions?

5.5 If PN/N to 5.1, or Y/PY to 5.2 or 5.3: Is there evidence that results were robust to the presence of missing data?

Optional: What is the predicted direction of bias due to missing data?

Bias in measurement of outcomes

6.1 Could the outcome measure have been influenced by knowledge of the intervention received?

6.2 Were outcome assessors aware of the intervention received by study participants?

6.3 Were the methods of outcome assessment comparable across intervention groups?

6.4 Were any systematic errors in measurement of the outcome related to intervention received?

Optional: What is the predicted direction of bias due to measurement of outcomes?

Bias in selection of the reported results

Is the reported effect estimate likely to be selected, on the basis of the results, from...

7.1. ... multiple outcome measurements within the outcome domain?

7.2 ... multiple analyses of the interventionoutcome relationship?

7.3 ... different subgroups?

Optional: What is the predicted direction of bias due to selection of the reported result?

Table. Risk of bias assessment of non-randomised studies of the effects of interventions (ROBINS-I tool).

Author, year	Bias due to confounding	Bias in selection of participants into the study	Bias in classification of interventions	Bias due to deviations from intended interventions	Bias due to missing data	Bias in measurement of outcomes	Bias in selection of the reported results	Overall Bias
Hartung et al., 2010	NI [1]	Serious [2]	Moderate [3]	Low	Low	Low	Low	Serious
Park et al., 2015	Moderate[4]	Low	Serious [5]	Low	Low	Serious [6]	Serious [7]	Serious
Althoff et al., 2015	Low	Low	Moderate [8]	Low	Low	Serious [9]	Moderate [10]	Serious
Petscavage-Thomas and Gustas, 2016	Low	Low	Moderate [8]	Low	Low	Serious [9]	Moderate [10]	Serious
Just et al., 2018	Moderate [11]	Moderate [12]	Moderate [13]	Low	Low	NI [14]	Moderate [15]	Moderate
Omar et al., 2018	Serious [16]	Moderate [12]	Serious [17]	Low	Low	NI [18]	Low	Serious
Hsu et al., 2018	Serious [16]	Serious [19]	Moderate [20]	Serious [21]	Serious [22]	Low	Low	Serious
Humby et al., 2018	Critical [23]	Low	Low	Low	NI [24]	Low	Moderate [10]	Critical
Lundstrom et al., 2019	Serious [25]	Low	Serious [26]	Moderate [27]	Low	Moderate [28]	Low	Serious
Gershkovich et al., 2019	Serious [16]	Low	Moderate [29]	Low	Low	Serious [30]	Serious [31]	Serious
Diffre et al., 2020	Serious [16]	Low	Moderate [29]	Moderate [27]	Low	Serious [30]	Moderate [7]	Serious

McKee et al., 2020	Serious [16]	Low	Moderate [29]	Moderate [27]	Low	Serious [30]	Moderate [7]	Serious
Henne et al., 2020	Serious [16]	Moderate [12]	Moderate [29]	Moderate [27]	NI [24]	Serious [30]	Serious [31]	Serious

NI= no information; [1]no information on confounding; [2]selection into the study is related to intervention and outcome and intervention group is classified after outcome assessment; [3]some aspects of the assignment of intervention status are determined retrospectively; [4]no clear confounding found, no methods for protecting for confounding; [5]the stratification is at high risk for bias (patients chose procedure after information on costs and pros and cons); [6]few information on the process of outcome measurement, no blinding is done, retrospective study; [7]conclusions are drawn from a small part of the results; [8]intervention groups are only partially clearly defined; [9]minimal information available on outcomes measurement; [10]results derive from one domain of the outcomes; [11]reliability and validity of measurement of important domains are sufficient, so we do not expect serious residual confounding; [12]no information on patients selection; [13]intervention status is partially affected by knowledge of the outcome; [14]no information on outcome assessment, retrospective study; [15]no selection of reported outcomes; [16]at least one important domain is not appropriately measured, or not controlled for confounding; [17]the lack of adequate reasoning why a patient is classified in the respective group leads to the possible bias; [18]no information on outcome assessment; [19]selection into the study is related to intervention and outcome; [20]some aspects of the assignment of intervention status are determined retrospectively; [21]some patients do not adhere to the assigned intervention regimen, and an appropriate analysis used to estimate the effect of starting and adhering to the intervention is not performed; [22]no evidence that results are robust due to the presence of missing data; [23]several domains are not protected for confounding (e.g. different study centres, different people performing the intervention, different diseases); [24]no information on missing data; [25]at least one important domain is not appropriately measured, or not controlled for confounding (e.g. confounding risk for exact injection point); [26]the lack of adequate reasoning why a patient is classified in the respective group leads to the possible bias; [27]no information on co-interventions; [28]the methods of outcome assessment are probably similar between groups, the knowledge of the intervention can change the outcome, retrospective study; [29]no information if the data used to define intervention groups are recorded at the start of the intervention; [30]no or only minimal information available on outcomes measurement; [31]the reported effect estimates likely to be selected.

Risk of bias assessment of randomised clinical trials

The risk-of-bias tool for randomized trials (RoB 2) is structured into five domains through which bias might be introduced into the result (Sterne JAC, et al. RoB 2: a revised tool for assessing risk of bias in randomised trials. BMJ 2019;366:l4898). The response options for the signalling questions are: "Yes"; "Probably yes"; "Probably no"; "No"; "No information". To maximize the signalling questions' simplicity and clarity, they are phrased so that a response of "Yes" may be indicative of either a low or high risk of bias, depending on the most natural way to ask the question. The tool includes algorithms that map responses to signalling questions onto a proposed risk-of-bias judgement for each domain, and then reaching an overall risk-of-bias judgement for a specific outcome. The possible risk-of-bias judgements are: "Low risk of bias" - the study is judged to have a low risk of bias for all domains for this result.; "Some concerns" - the study is judged to raise some concerns in at least one domain for this result, but not to have a high risk of bias for any domain.; "High risk of bias" - the study is judged to have a high risk of bias in at least one domain for this result, Or the study is judged to have some concerns for multiple domains in a way that substantially lowers confidence in the result.

Risk of bias questions (RoB 2)

Bias arising from the randomization process

1.1 Was the allocation sequence random?

1.2 Was the allocation sequence concealed until participants were enrolled and assigned to interventions?

1.3 Did baseline differences between intervention groups suggest a problem with the randomisation process?

Optional: What is the predicted direction of bias arising from the randomization process?

Bias due to deviations from intended interventions

2.1 Were participants aware of their assigned intervention during the trial?

2.2 Were carers and people delivering the interventions aware of participants' assigned intervention during the trial?

2.3. If Y/PY/NI to 2.1 or 2.2: Were important co-interventions balanced across intervention groups?

2.4. Was the intervention implemented successfully?

2.5. Did study participants adhere to the assigned intervention regimen?

2.6. If N/PN/NI to 2.3, 2.4 or 2.5: Was an appropriate analysis used to estimate the effect of starting and adhering to the intervention?

Optional: What is the predicted direction of bias due to deviations from intended interventions?

Bias due to missing outcome data

3.1 Were data for this outcome available for all, or nearly all, participants randomised?

3.2 If N/PN/NI to 3.1: Is there evidence that the result was not biased by missing outcome data?

3.3 If N/PN to 3.2: Could missingness in the outcome depend on its true value?

3.4 If Y/PY/NI to 3.3: Is it likely that missingness in the outcome depended on its true value?

Optional: What is the predicted direction of bias due to missing outcome data?

Bias in measurement of the outcome

4.1 Was the method of measuring the outcome inappropriate?

4.2 Could measurement or ascertainment of the outcome have differed between intervention groups?

4.3 If N/PN/NI to 4.1 and 4.2: Were outcome assessors aware of the intervention received by study participants?

4.4 If Y/PY/NI to 4.3: Could assessment of the outcome have been influenced by knowledge of intervention received?

4.5 If Y/PY/NI to 4.4: Is it likely that assessment of the outcome was influenced by knowledge of intervention received?

Optional: What is the predicted direction of bias in measurement of the outcome?

Bias in selection of the reported result

5.1 Were the data that produced this result analysed in accordance with a prespecified analysis plan that was finalised before unblinded outcome data were available for analysis?

Is the numerical result being assessed likely to have been selected, on the basis of the results, from:

5.2 ... multiple eligible outcome measurements (eg, scales, definitions, time points) within the outcome domain?

5.3 ... multiple eligible analyses of the data? N/PN Y/PY NI

Optional: What is the predicted direction bias due to selection of the reported results?

Table. Risk of bias assessment of randomised clinical trials (RoB 2).

Author, year	Randomisation process	Deviations from intended interventions	Missing outcome data	Measurement of the outcome	Selection of the reported result	Overall Bias
Naredo et al., 2004	Some concerns [1]	Low	Low	Low/High [2]	Low	Some concerns/ High
Luz et al., 2008	Some concerns [3]	Low	Low	Some concerns [4]	Low	Some concerns
Sibbitt et al., 2009	Some concerns [1]	Low	Low	Some concerns [5]	Low	Some concerns
Im et al., 2009	Some concerns [6]	Low	Low	Some concerns [7]	Low	Some concerns
Lee et al., 2009	Some concerns [1]	Low	Low	Low	Low	Some concerns
Cunnington et al., 2010	Some concerns [1]	Low	Low	Low	Low	Some concerns
Hashiuchi et al., 2011	Some concerns [1]	Low	Low	Low	Low	Some concerns
Zhang et al., 2011	High [8]	Low	Some concerns [9]	Some concerns [10]	Some concerns [11]	High
Park et al., 2011	Some concerns [1]	Low	Low	Low	Low	Some concerns
Sibbitt Jr et al., A randomized controlled trial evaluating the cost-effectiveness of sonographic guidance for intra-articular injection of the osteoarthritic knee, 2011	Some concerns [1]	Low	Low	Some concerns [5]	Low	Some concerns
Sibbitt Jr et al., A randomized controlled trial of the cost-effectiveness of ultrasound-guided intraarticular injection of inflammatory arthritis, 2011	Some concerns [1]	Low	Low	Some concerns [5]	Low	Some concerns
Sibbitt et al., 2012	Some concerns [12]	Low	Low	Some concerns [5]	Low	Some concerns
Bum Park et al., 2012	Some concerns [1]	Low	Low	Low	Low	Some concerns
Jang et al., 2013	Some concerns [1]	Low	Low	Some concerns [5]	Low	Some concerns
Sabeti-Aschraf et al., 2013	Low	Low	Low	Low	Some concerns [13]	Low

Makhlouf et al., 2014	Low	Low	Low	High [14]	Some concerns [15]	High
Park et al., 2013	Some concerns [1]	Low	Low	Low	Low	Some concerns
Ustun et al., 2013	Some concerns [1]	Low	Low	Low	Some concerns [16]	Some concerns
Kim et al., 2013	Some concerns [1]	Low	Low	Low	Low	Some concerns
Chang et al., 2014	Some concerns [1]	Low	Low	Low	Low	Some concerns
Fowler et al., 2014	High [12]	Low	Low	Some concerns [5]	Low	High
Saeed et al., 2014	Low	Low	High [17]	Low	Low	High
Jee et al., 2014	Some concerns [1]	Low	Low	Some concerns/High [18]	Low	High
Cecen et al., 2015	High [20]	Low	Low	Low	Low	High
Soneji et al., 2016	Some concerns [1]	Low	Low	Some concerns [5]	Low	Some concerns
Shinomiya et al., 2016	Some concerns [21]	Low	Low/High [22]	Some concerns [23]	Low	Some concerns/High
Cho et al., 2016	Low	Low	Low	Low	Low	Low
Raeissadat et al., 2017	High [24]	Low	Low	Some concerns [25]	Low	High
Eslamian et al., 2017	Some concerns [1]	Low	Low	Low	Low	Some concerns
Orlandi et al., 2017	Some concerns [1]	Low	Some concerns [26]	Some concerns [27]	Low	Some concerns
Mardani-Kivi et al., 2018	Some concerns [1]	Low	Low	Low	Low	Some concerns
Mitchell et al., 2018	Some concerns [1]	Low	Low	High [14]	Some concerns [15]	High
Nordberg et al., 2018	Some concerns [28]	Low	Low	Low	Some concerns [29]	Some concerns
Lee et al., 2018	Some concerns [1]	Low	Low	Some concerns [5]	Low	Some concerns
Babaei-Ghazani et al., 2018	Some concerns [1]	Low	Low	Some concerns [5]	Low	Some concerns
Khallaf et al., 2018	High [30]	High [31]	Low	Low	Low	High
Chen et al., 2018	Some concerns [32]	Low	Low	Some concerns [5]	Low	Some concerns
Pan et al., 2019	Some concerns [33]	Low	High [34]	High [35]	High [36]	High
Kim et al., 2019	Some concerns [1]	Low	Low	Some concerns [5]	Low	Some concerns
Hak Roh et al., 2019	Some concerns [1]	Low	Low	Some concerns [5]	Low	Some concerns

Vahdatpour et al., 2019	High [24]	Low	Low	Low	Low	High
Roh et al., 2019	Some concerns [1]	Low	High [37]	Some concerns [38]	Low	High
Lee et al., 2019	Some concerns [39]	Low	Low	Low	Low	Some concerns
Rayegani et al., 2019	Some concerns [39]	Low	Low	Low	Low	Some concerns
Cohen et al., 2019	Low	Low	Low	Low	Low	Low
Sheth et al., 2020	Some concerns [39]	Low	Low	High [27]	Low	High
Yiannakopoulos et al., 2020	Some concerns [1]	Low	Low	High [40]	Low	High
Babaei-Ghazani et al., 2020	Some concerns [41]	Low	Low	Low	Low	Some concerns
Cankurtaran et al., 2020	High [42]	Low	Low	Low	Low	High

[1]no information when allocation is concealed; [2]not well described if the ultrasound also performed the procedure (high risk of bias only for accuracy outcome); [3]few information on randomization process; [4]no description on what is measured exactly as outcomes; [5]scarce information on outcomes measurement; [6]no information on the randomization process; [7]no information who assessed x-ray imaging, no information on blinding; [8]no information on the randomization process and when allocation is concealed, unequal number of participants between groups; [9]no information on patients lost to follow up; [10]not clear who decided whether or not another injection was needed and whether this person was blinded to the group assignment; [11]multiple time points measured but only two time points reported (the first and the last visit) and it is unclear whether these time points are not measured; [12]demographic data are not described; [13]unclear in some reported results; [14]no blinding of outcome assessor; no information on outcomes measurement; [15]some variables are only measured at 2 week time-point; [16]no adjustment for repeated measurements (but only 3 time-points: baseline-6 weeks-12 weeks); [17]considerable number of patients excluded due to repeated injections/surgery; [18]using ultrasound and fluoroscopy to guide an injection and then assessing the success of the procedure using fluoroscopy has a risk of leading to a measurement bias (accuracy outcome), missing information on adverse events and patient satisfaction outcome measures, Pain and Function outcomes had low risk of bias; [20]the randomisation leads to a significant larger amount of females in the US group compared to the blind group, no info when allocation is concealed; [21]no information on the randomization process and when allocation is concealed; [22]reason for patients lost to follow up and not integrated in the analysis is unclear (only for recurrence of symptoms outcome), for the other outcomes low risk of bias; [23]a hand surgeon not blinded to the treatment assignment performed all US studies; [24]unbalanced baseline data; [25]no information whether outcome assessor is blinded; [26]from 107 treated patients in one needle group, 7 are lost at baseline, 4 are lost at 3 months and 6 are lost at 1 year (in total 16%), 102 per group was needed according to sample size calculations, 10% of patients were lost at 1 year in the 2 needle group; [27]outcomes assessment is performed by the same person performing the intervention; [28]more female than male in one group compared to the other; [29]the study is most probably not designed for some type of analysis, being a secondary analysis; [30]differences at the baseline, before the injection, for the item “internal rotation”; [31]no information about intended interventions; no information about time-points; [32]randomization is done by coin toss, leading to baseline imbalances which are not well described, no statistical testing for baseline differences; [33]no information on the randomization process, no info on age/gender; [34]>10% lost to follow up; no information on sample size calculation; [35]no information who assessed the outcomes; it is not clear whether this missing of blindness could have affected the outcome; [36]p value for grading is calculated using a t test; however, no information at which time-point it is significant ad no adaption for repeated measures; [37]high dropouts, more than estimated in the sample size calculation; [38]unclear who measures outcomes; [39]few information on randomization process; no information when allocation is concealed; [40]no information on who assesses outcomes, probably it is the same one who performs the intervention; [41]no information on some baseline data (e.g. sex, comorbidities), no information on instruments for procedures; [42]no information on demographic data and comorbidities.

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