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Ana Rita Barroca de Macedo

Is surgical suture type associated with Carpal Tunnel Release results? A prospective study

Estudo prospetivo sobre o efeito do tipo de fio de sutura na descompressão cirúrgica do Túnel Cárpico

MARÇO, 2020

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UC Dissertação/Projeto (6º Ano) - DECLARAÇÃO DE INTEGRIDADE

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Ortopedia e Traumatologia

TÍTULO DISSERTAÇÃO/~~MONOGRAFIA~~ (riscar o que não interessa)

Is surgical suture type associated with Carpal Tunnel Release results? A prospective study

ORIENTADOR

Professor Doutor João Torres

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AGRADECIMENTOS

Trabalho dedicado aos meus avós.

À minha Família, o meu pilar em todas as circunstâncias da vida.

Ao meu irmão Gonçalo, que foi essencial para a realização deste trabalho.

Ao meu Pai, que me dá o verdadeiro exemplo do que é ser Médico.

Aos meus amigos, que sempre estiveram a meu lado para me incentivar.

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Ao meu Orientador, por toda a motivação e disponibilidade demonstrada.

A todos vocês, MUITO OBRIGADA!

Rita

Is surgical suture type associated with Carpal Tunnel Release results? A prospective study

ABSTRACT

Objective: To evaluate the effect of the string used during Carpal Tunnel Surgical Release on post-surgical outcome.
Methods: Patients with programmed CTSR were prospectively recruited between February and July 2019. We assessed socio-demographic characteristics (age, gender and occupation) along with other factors relevant to this study (EMG reports pre-op, comorbidities, laterality and hand dominance). Moreover, we applied the quick form of the Disabilities of the Arm, Shoulder and Hand (quickDASH) questionnaire before and after surgery (between three- and six-months post-op), in order to assess the differences in surgical outcomes of the two compared strings: Nylon and Poliglecaprone 25.
Results: Study sample consisted of 38 patients. The overall quickDASH score significantly improved after CTSR, as well as each item of the questionnaire. There were no statistically significant differences between the two strings in terms of evolution of the quickDASH score and absenteeism from work.
Conclusion: CTSR significantly improved the quality of life of interventioned patients, irrespectively the type of suture used. No recommendation for a preferable type of string could be suggested to improve postsurgical outcome.

Keywords: Carpal Tunnel Surgical Release (CTSR), CTSR results, CTSR strings

Estudo prospetivo sobre o efeito do tipo de fio de sutura na descompressão cirúrgica do Túnel Cárpico

RESUMO

Objetivo: Avaliar o efeito de diferentes tipos de fios de sutura nos resultados da descompressão do Túnel Cárpico.
Métodos: Entre Fevereiro e Julho de 2019, recrutámos, de modo prospetivo, os doentes com agendamento da cirurgia de descompressão do Túnel Cárpico. As características sociodemográficas foram avaliadas (idade, género e ocupação), bem como outras variáveis relevantes para o estudo, tais como os relatórios da EMG pré-cirúrgica, co-morbilidades, mãos dominante e intervencionada. Para além disto, foi aplicada a versão curta do questionário quickDASH (Disabilities of the Arm, Shoulder and Hand) antes e entre três e seis meses após cirurgia, com o objetivo de avaliar as diferenças nos resultados cirúrgicos utilizando dois fios de sutura diferentes: Nylon e Poliglecaprone 25.
Resultados: A amostra incluiu 38 participantes, destacando-se que houve uma melhoria significativa na pontuação do quickDASH, bem como em cada item do questionário, após a descompressão cirúrgica. Para além disto, não houve diferenças estatisticamente significativas, entre os dois fios comparados, em termos de evolução da pontuação do quickDASH e de absentismo laboral.
Conclusão: A descompressão do Túnel Cárpico melhorou significativamente a qualidade de vida dos doentes intervencionados, sendo que não foi identificada nenhuma vantagem consoante o tipo de fio de sutura utilizado.

Palavras-chave: Síndrome do Túnel Cárpico (STC), Cirurgia de descompressão STC, fios de sutura

INTRODUCTION

The Carpal Tunnel Syndrome (CTS) is one of the most prevalent compressive neuropathies in the world, affecting most commonly working-aged adults(1), and carrying substantial physical, psychological and even economic consequences(2,3).

CTS is characterized by the compression of the Median Nerve, in the wrist area, resulting in severe burden of symptoms, such as pain and paraesthesia, affecting drastically the quality of life of these patients(1,4,5). Many conditions, such as oedema, tendon inflammation, hormonal changes and manual activity have been extensively described in the literature as to increase the risk of developing CTS(6). Moreover, it has been well stablished that conditions such as diabetes mellitus, pregnancy, breastfeeding and obesity are intrinsically related to the clinically relevant manifestation of this compressive neuropathy(7–10). Therefore, middle-aged women tend to develop CTS more commonly than man(1,11).

The management of this condition can be either conservative (e.g. by using nocturnal wrist splinting) or surgical, depending on the severity of symptoms, electromyography (EMG) findings and failure of previous conservative treatment(1,4).

Carpal Tunnel Surgical Release (CTSR) consists of the transection of the transverse carpal ligament and it is considered to be the gold standard in the treatment of CTS(4,6,11,12). This surgery can be performed either by traditional open (OCTR) or by endoscopic technique (ECTR)(4,6).

Despite the generally favourable surgical decompression

outcome through CTSR, the time of absence from work is widely variable and the frequency of scar-related complaints is still under investigation(13).

The choice of wound closure material is exceedingly dependent on numerous factors, such as tissue tension, repair type, patient's ability to care for the wound and return for suture removal, skin integrity, and wound location(14). For instance, one of the first decisions that the surgeon must make when suturing is deciding whether to use an absorbable or non-absorbable string.

The aim of this study was to evaluate the effect of the string used during Carpal Tunnel Surgical Release on post-surgical outcome.

PATIENTS AND METHODS

This study was performed prospectively after obtaining Ethical approval from our institution review board.

From February to July 2019, we have recruited 142 patients with programmed Carpal Tunnel Surgical Release (CTSR) from our institution's (Universitary Central Hospital) clinical electronic database. Data such as age, gender, EMG reports, comorbidities (e.g.: diabetes) and operated hand (laterality) were collected from the hospital's database.

All participants had a first contact by telephone one week before their Carpal Tunnel Surgical Release (CTSR). During this interview, participants were asked about their occupation and hand dominance. Additionally, we recorded their answers to the quick form of the Disabilities of the Arm, Shoulder and Hand (quickDASH)

questionnaire, which uses eleven items to evaluate physical functions, symptoms and the burden of the CTS on their daily activities. Each item was scored between 1 and 5, ranging from no difficulty in performing the activity/no symptoms to unable to perform activity/very severe symptoms(5,15).

After surgery, participants were again contacted, between the third- and sixth-month post-op and, in this phone interview, they were asked to answer verbally to the quickDASH questionnaire. Furthermore, all patients were inquired about their time of absence from work.

CTSR was performed in all patients, under general anaesthesia, by orthopaedic surgeons from the Orthopaedics and Traumatology Department. The surgical suture types used were Nylon and Poliglecaprone 25. Nylon suture is a non-absorbable monofilament synthetic suture, most commonly used for cutaneous wound closure(16). Poliglecaprone 25 suture is an absorbable monofilament with high tensile strength(14). The choice between both was made based on surgeon's preference.

Statistical analysis was performed using SPSS v. 25 (IBM®, Armonk, NY). The Kolmogorov-Smirnov test was applied to test for a normal distribution of each variable. Data was analysed using the t-test for independent and dependent-samples, the Chi-squared test for categorical variables and the Mann-Whitney U nonparametric test for continuous variables. Statistical significance was considered if the p-value was less than 0.05.

RESULTS

We were able to identify one hundred and forty-two patients with programmed Carpal Tunnel Surgical Release from our clinical electronic database. All these participants were contacted in order to complete the first telephone interview. Seventy-six patients were excluded, since they missed the first initial contact. Moreover, three patients refused to participate in this study and fifteen missed or cancelled their programmed surgery. Altogether, ninety-four participants were excluded from the analysis as they did not fulfil the required criteria, resulting in a cohort of forty-eight participants.

Between three- and six-months post-op, all forty-eight patients were contacted once more to collect the necessary data. Nonetheless, six participants missed the second phone interview, while other four missed/decided to cancel their surgery for the time being, resulting in a total of thirty-eight participants to be included in this study (see figure 1).

As mentioned earlier, there were thirty-eight participants considered for this study, whose demographic characteristics are summarized in table 1: thirty-five women (92.1%) and three men (7.9%), with an average age of 51.3 years, were submitted to the statistical analysis. Nylon suture type was used in 50.0% of the participants, while Poliglecaprone 25 was used in 28.9% of the cases. There was no information about the type of suture used, in the clinical database, in eight patients (21.0%).

Table 1: Summary of participants characteristics

	Men **(n=3)** **7.9%**	Women **(n=35)** **92.1%**	Total **(n=38)**
Age (mean ± SD, years)	50.5 ± 4.9	49.9 ± 10.4	51.3 ± 10.2
Diabetes (%)	2 (66.7)	1 (2.9)	3 (8.6)
Hand dominance (%)			
Right	3 (100)	34 (97.1)	37 (97.4)
Left	0	1 (2.9)	1 (2.6)
Hand surgery (%)			
Right	1 (33.3)	22 (62.9)	23 (60.5)
Left	2 (66.7)	13 (37.1)	15 (39.5)
Dominant hand surgery (%)	1 (33.3)	23 (65.7)	24 (63.2)
Surgical suture type (%)			
Nylon	2 (66.7)	17 (48.6)	19 (50.0)
Poliglecaprone 25	0	11 (31.4)	11 (28.9)
No data available	1 (33.3)	7 (20.0)	8 (21.0)
EMG Results **(%)**			
Light	1 (33.3)	6 (17.1)	7 (18.4)
Moderate	2 (66.7)	7 (20.0)	9 (23.7)
Severe	0	5 (14.3)	5 (13.2)
No data available	0	17 (48.6)	17 (44.7)

We compared the two groups of patients included in the study (Nylon vs. Poliglecaprone 25) and were able to infer that there are no statistically significant differences between them (Table 2). Thus, they are suited for the posterior analysis.

Table 2: Comparison between groups' characteristics

		Nylon	Poliglecaprone 25	p value
Age (mean ± SD, years)		50.1 ± 9.4	49.6 ± 11.5	1.0
Gender (n, %)	**Female**	17 (60.7%)	11 (39.3%)	0.265
	Male	2 (100%)	0	
Dominant Hand Surgery	**No**	4 (36.4%)	7 (63.6%)	0.020
	Yes	15 (78.9%)	4 (21.1%)	
Return to work (months)		2.0± 1.6	1.9 ± 1.3	0.832
Initial quickDASH (mean ± SD)		0.66 ± 0.17	0.70 ± 0.09	0.641
quickDASH Evolution (mean ± SD)		-0.39 ± 0.28	-0.47 ± 0.27	0.287

We compared the quickDASH score before and after surgery and concluded that there was a statistically significant difference in the evolution of the quickDASH score ($p<0.001$). Additionally, we compared the score of each item of the quickDASH questionnaire before and after surgery. Based on these results, there was a statistically significant difference in all items, with $p<0.001$, except in question 7 ($p=0.026$).

Moreover, we compared the evolution of each item in the quickDASH score (i.e.: before and after surgery), according to the type

of suture used. There was one item of the score (question 1) with a statistically significant difference before and after surgery: -0.63 ± 1.61 with Nylon suture and -2.45 ± 1.37 with Poliglecaprone 25 (p=0.003).

Table 3: Evolution of each item in the quickDASH score

Question	Suture type	Mean	Standard deviation (SD)	p values
1	Nylon	-0.63	1.61	0.004
	Poliglecaprone 25	-2.45	1.37	0.003
2	Nylon	-1.26	1.91	0.135
	Poliglecaprone 25	-2.27	1.35	0.103
3	Nylon	-1.16	1.64	0.739
	Poliglecaprone 25	-1.36	1.57	0.737
4	Nylon	-1.89	1.76	0.312
	Poliglecaprone 25	-1.18	1.94	0.328
5	Nylon	-1.42	1.43	0.568
	Poliglecaprone 25	-1.73	1.35	0.563
6	Nylon	-1.74	1.49	0.098
	Poliglecaprone 25	-0.73	1.68	0.114
7	Nylon	-0.42	1.31	0.265
	Poliglecaprone 25	-1.09	1.92	0.320
8	Nylon	-1.21	1.69	0.609
	Poliglecaprone 25	-1.55	1.75	0.615
9	Nylon	-2.21	1.51	0.455
	Poliglecaprone 25	-2.64	1.43	0.450
10	Nylon	-2.74	1.45	0.613
	Poliglecaprone 25	-3.00	1.18	0.594
11	Nylon	-2.53	1.39	0.526
	Poliglecaprone 25	-2.82	0.751	0.462

Finally, we compared the evolution of the quickDASH score and the absenteeism from work with the type of suture used and concluded that there were no differences in these groups.

DISCUSSION

The clinical presentation of CTS is typical, and, with a comprehensive history and a thorough physical examination, final diagnosis is easily attainable(11). First symptoms of CTS are intermittent paraesthesia and numbness, which are often worse at night, and pain. The concern with these symptoms is that they gradually become more frequent and debilitating(6). In severe cases, physical examination of these patients may show muscle wasting, particularly in the thenar eminence, resulting in weakness in thumb opposition(1). Some patients also complain about pain and fatigue in the arm or shoulder(6,11).

To diagnose CTS with efficacy, clinicians usually resort to the Tinel's sign, Phalen's manoeuvre and Durkan's test, whose sensitivity and specificity are widely variable(6,11,17). Tinel's sign is performed by tapping on the volar surface of the wrist and, if positive, it causes paraesthesia in median nerve-innervated fingers. A positive Phalen's manoeuvre for CTS occurs when there is pain and/or paraesthesia on extending the wrist and maintaining this position for 60 seconds(6,11). Durkan's test consists of direct compression of the median nerve for thirty seconds, and it is considered positive with the onset of paraesthesia and/or pain in median nerve territory(17).

Even though CTS diagnosis is mostly clinical, it might be useful to ensure an electrophysiological assessment of the median nerve disfunction. For this reason, Electromyography (EMG) findings may report some degree of axonal loss, which has implications in terms of prognosis(6,11).

Management of CTS can be accomplished either by surgical or non-surgical treatment, and the clinician should inform the patient about the advantages and disadvantages of each strategy(6). Conservative treatment is usually provided to patients with mild to moderate symptoms(11) as opposed to surgical treatment, which should be preferred in cases where patients are not responding to conservative measures(4).

Non-surgical treatment options include lifestyle changes (e.g, limitation of wrist movement and reduction of heavy work activities), laser therapy, local corticosteroids injections, therapeutic ultrasound and musculoskeletal splinting(6). Even though patients might report some symptomatic relief with the use of conservative options, as our cohort of patients did in fact experience, this is only temporary and therefore many patients become candidates to surgical release a few months after initiating these measures. Surgical approach has been proven to be a better treatment option for patients with CTS, due to its longer lasting effects, as well as its ability to improve electrophysiological measures(6,11,18,19).

Carpal Tunnel Surgical Release, as mentioned earlier, comprises the transection of the transverse carpal ligament, resulting in decompression of the median nerve(11). This surgery can be performed either by traditional open technique (OCTR), with a longitudinal wrist incision, or by endoscopic technique (ECTR)(4,6). Studies have shown that, in terms of long-term functional outcome, there is no significant difference between open and endoscopic release, as it might depend on the expertise of the performing surgeon(6). However, there are slight differences between the two techniques that

must be taken into consideration. For instance, ECTR has shown faster relief from pain and sooner improvement in functional activities in the first two weeks post-op(11), and it is associated with fewer complications, such as scar pain and infection(6,20). However, this technique carries a greater risk for transient nerve damaging in addition to the fact that it is more expensive than OCTR(6,11). As a result, carpal tunnel decompression with open surgery is considered the gold standard in the treatment of CTS(4,11,12).

Many instruments have been proposed in order to assess the surgery's performance, patients' symptoms and their functionality in daily life, such as the Boston Carpal Tunnel Questionnaire (BCTQ), the Michigan Hand Outcome Questionnaire (MHQ) and the quick form of Disabilities of the Arm, Shoulder and Hand (DASH) questionnaire. Ideally, clinically useful and easily administered questionnaires are preferred(5). For this reason, we implemented the quickDASH questionnaire in all participants in this study. One advantage of this scoring method relies on the fact that it is easily applied via telephone, which was important in our study, since we had to contact participants on, at least, two different occasions (pre- and post-op). Regardless of this, participants' adherence was limited, but we believe that it would have been poorer if we were to ask participants to come to the hospital exclusively for this purpose.

Carpal tunnel decompression with open surgery was the standard technique used in all participants, thus the only noteworthy variable was the use of nylon or poliglecaprone 25 sutures in those procedures. Nylon suture is a non-absorbable monofilament synthetic suture, most commonly used for cutaneous wound closure(16). Its

advantages rely on the fact that it has high tensile strength, good elasticity, low potential for tissue reactivity and it is inexpensive(14,16). Poliglecaprone 25 suture is an absorbable monofilament with high tensile strength, very low tissue reactivity and the highest knot security of all the synthetic absorbable sutures(14).

By comparing the overall quickDASH score before and after surgery, as well as comparing each item comprised in the questionnaire, we concluded that the Carpal Tunnel Surgical Release by open surgery was efficient in reducing all patients' symptoms and improved hand function, which is in accordance with data from literature(19,21).

Moreover, we understood that there were no differences in the evolution of the quickDASH score according to the type of suture used. This might be explained by the fact that our cohort was smaller than initially predicted. Nonetheless, with our cohort, we were able to identify a statistically significant difference in the quickDASH score before and after surgery, which supports the usefulness of the surgical clinical decision.

In brief, we consider that the type of suture used does not modify the surgical outcome in patients submitted to CTSR, and so the type of suture used in each procedure can be in accordance to the surgeon's preference.

CONCLUSION

CTSR significantly improved the quality of life of interventioned patients, irrespectively of the type of suture used. No recommendation for a preferable type of string could be suggested to improve postsurgical outcome.

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FIGURES

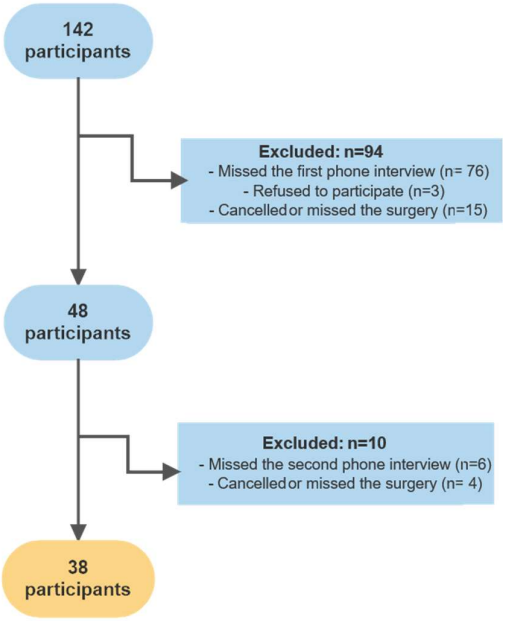

Figure 1: Flowchart of the numbers of participants initially included, excluded, and reasons for exclusion.

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INSTRUCTIONS TO AUTHORS

(Reviewed January 2016)

The journal Acta Ortopédica Brasileira, official organ of the Department of Orthopedics and Traumatology, Faculdade de Medicina da Universidade de São Paulo (DOT/FMUSP), is published bimonthly in six issues per year (jan/feb, mar/apr, may/jun, jul/aug, sep/oct, and nov/dec) with English version. The titles, abstracts and keywords are published in English and Portuguese. The publication follows entirely the international standard of the International Committee of Medical Journal Editors (ICMJE) - Vancouver Convention - and its uniform requirements [http://www.icmje.org/]. Submitted papers are sent for double-blind peer review evaluation to decide whether they should be published or not, suggesting improvements, asking the authors for clarification and making recommendations to the Editor-in Chief. The concepts and statements contained in the papers are the sole responsibility of the authors.
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ARTICLES FORMAT

NUMBER OF WORDS RECOMMENDED ACCORDING TO THE PUBLICATION TYPE: The criteria specified below should be observed for each type of publication. The electronic counting of words should start at the Introduction and end at the Conclusion.

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Type of Article	Abstract	Number of words	References	Figures	Tables	Maximum number of authors allowed
Original	Structured, up to 200 words	2.500 Excluding abstract, references, tables and figures	20	10	6	6
Update / Review*	Non-structured, up to 200 words	4.000 Excluding abstract, references, tables and figures	60	3	2	2
Editorial*	No abstract	500	0	0	0	1

*These contributions shall be published at the Editors' criteria, with due replica, when applicable.

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ACKNOWLEDGEMENTS: Authors can acknowledge financial support to the work in the form of research grants, scholarships and other, as well as professionals who do not qualify as co-authors of the article, but somehow contributed to its development.

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ABSTRACT: The abstract in Portuguese and in English should be structured in cases of original articles and shall present the study's objectives clearly, methods, results and main conclusions and should not exceed 200 words (do not include any reference citations). Moreover, the abstract should include the level of evidence and the type of study, according to the classification table attached at the end of this text.

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INTRODUCTION: The introduction of the article shall present the matter and purpose of the study, including citations without, however, making an extensive review of the matter.

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Link the conclusions with the goals of the study, but avoid statements and conclusions that are not supported by the data, in particular the distinction between clinical and statistical relevance. Avoid making statements on economic benefits and costs, unless the manuscript includes data and appropriate economic analysis. Avoid priority claim ("this is the first study of ...") or refer to work that has not yet been completed.

CONCLUSION: The conclusion should be clear and concise, establishing a link between the conclusion and the study objectives. Avoiding conclusions not based on data from the study in question is recommended, as well as avoiding suggest that studies with larger samples are needed to confirm the results of the work in question.

ACKNOWLEDGEMENTS
When applicable, briefly acknowledge the people who have contributed intellectually or technically to the study, but whose contribution does not justify co-authorship. The author must ensure that people agree to have their names and institutions disclosed. Financial support for the research and fellowships should be acknowledged in this section (funding agency and project number).

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Levels of Evidence for Primary Research Question[a]

(This chart was adapted from material published by the Centre for Evidence-Based Medicine, Oxford, UK. For more information, please visit www.cebm.net.)

	Types of study			
Level	**Therapeutic Studies Investigating the Results of Treatment**	**Prognostic Studies – Investigating the Effect of a Patient Characteristic on the Outcome of Disease**	**Diagnostic Studies – Investigating a Diagnostic Test**	**Economic and Decision Analyses – Developing an Economic or Decision Model**
I	High quality randomized trial with statistically significant difference or no statistically significant difference but narrow confidence intervals	High quality prospective study[d] (all patients were enrolled at the same point in their disease with ≥80% of enrolled patients)	Testing of previously developed diagnostic criteria on consecutive patients (with universally applied reference ''gold'' standard)	Sensible costs and alternatives; values obtained from many studies; with multiway sensitivity analyses
	Systematic review[b] of Level RCTs (and study results were homogenous[c])	Systematic review[b] of Level I studies	Systematic review[b] of Level I studies	Systematic review[b] of Level I studies
II	Lesser quality RCT (eg, < 80% followup, no blinding, or improper randomization)	Retrospective[f] study	Development of diagnostic criteria on consecutive patients (with universally applied reference ''gold'' standard)	Sensible costs and alternatives; values obtained from limited studies; with multiway sensitivity analyses
	Prospective[d] comparative study[e]	Untreated controls from an RCT	Systematic review[b] of Level II studies	Systematic review[b] of Level II studies
	Systematic review[b] of Level II studies or Level I studies with inconsis tent results	Lesser quality prospective study (eg, patients enrolled at different points in their disease or <80% followup)		
		Systematic review[b] of Level II studies		
III	Case control study[g]	Case control study[g]	Study of non consecutive patients; without consistently applied reference ''gold'' standard	Analyses based on limited alternatives and costs; and poor estimates
	Retrospective[f] comparative study[e]		Systematic review[b] of Level III studies	Systematic review[b] of Level III studies
	Systematic review[b] of Level III studies		Case-control study	
			Poor reference standard	
IV	Case series[h]	Case series		Analyses with no sensitivity analyses
V	Expert opinion	Expert opinion	Expert opinion	Expert opinion

[a] A complete assessment of quality of individual studies requires critical appraisal of all aspects of the study design.
[b] A combination of results from two or more prior studies.
[c] Studies provided consistent results.
[d] Study was started before the first patient enrolled.
[e] Patients treated one way (eg, cemented hip arthroplasty) compared with a group of patients treated in another way (eg, uncemented hip arthroplasty) at the same institution.
[f] The study was started after the first patient enrolled.
[g] Patients identified for the study based on their outcome, called "cases" eg, failed total arthroplasty, are compared with patients who did not have outcome, called ''controls'' eg, successful total hip arthroplasty.
[h] Patients treated one way with no comparison group of patients treated in another way.