Chinese Journal of Traumatology xxx (2017) 1–5

Contents lists available at ScienceDirect

Chinese Journal of Traumatology

journal homepage: http://www.elsevier.com/locate/CJTEE

Original Article

Quadratus femoris muscle pedicle bone flap transplantation in the treatment of femoral neck fracture for Chinese young and middle-aged patients: A systematic review and meta-analysis

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ARTICLE INFO

Article history:
Received 20 March 2017
Received in revised form
9 August 2017
Accepted 19 August 2017
Available online xxx

Keywords:
Femoral neck fractures
Quadratus femoris muscle
Myocutaneous flap
Fracture fixation
Meta-analysis

ABSTRACT

Purpose: To compare the efficacy of quadratus femoris muscle pedicle bone flap transplantation combined with hollow compression screw fixation versus AO hollow compression screw fixation in the treatment of femoral neck fracture for Chinese young and middle-aged patients.

Methods: Case-controlled studies (CCTs) were used to compare the two operative methods in the treatment of femoral neck fractures. Data were retrieved from the Cochrane Library, Pubmed Database, CNKI, Chinese Biomedical Database.

Wanfang Data published during the period of January 2005 to December 2014. Methodological quality of the trials was critically assessed, and relevant data were extracted. Statistical Software Revman 5.0 was used for data-analysis.

Results: Eight articles were included in the meta-analysis. The results showed that there was statistical significance in the rate of fracture healing [$OR = 5.43$, 95% CI (2.89, 10.20), $p < 0.05$], the rate of good function of hip joint [$OR = 5.12$, 95% CI (3.21, 8.17), $p < 0.05$], the rate of femoral head necrosis [$OR = 4.21$, 95% CI (2.02, 8.76), $p < 0.05$], the time of fracture healing [WMD = −46.85, 95% CI (−65.13, −28.56), $p < 0.05$] between the two groups.

Conclusions: For the treatment of femoral neck fractures, the transplantation of quadratus femoris muscle pedicle bone flap combined with hollow compression screw; fixation is superior to the AO hollow compression screw fixation in terms of the rate; of fracture healing, the rate of good function of hip joint, the rate of femoral head; necrosis and the time of fracture healing.

Introduction

The management of femoral neck fractures especially the displaced ones in young adults is one of the most challenging tasks for orthopedic surgeons.[1–3] Femoral neck fractures are relatively rare in young patients which often result from high-energy trauma.[4,5] This kind of fracture is more prone to nonunion and femoral head necrosis because of its vertical fracture line in the collum femoris.[6,7] The main complication of femoral neck fracture in young adults is avascular necrosis, with the incidence of 15% (range 0–67%).[8] Accurate reduction and firm fixation are vital for optimal results. However, owing to the breakdown of blood supply because of great violence, meronecrobiosis and collapse of the femoral head are commonly seen clinically.[9]

Judet et al.[10] described a successful case by using quadrates femoris muscle pedicle bone graft combining with screw fixation to treat this kind of fracture in 1964. Later, some scholars reported that the transplantation of quadratus femoris muscle pedicle bone to the proximal femoral head fragment could increase the blood supply of the femoral head when intracapsular fracture took place.[11,12] But other scholars opposed this operation and believed that it might increase the risk of complications.[13,14] Meyers et al.[15] pointed out that this operation would prolong the operative time by at least half an hour and required nice surgical skill and assistance. Furthermore,

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Peer review under responsibility of Daping Hospital and the Research Institute of Surgery of the Third Military Medical University.

https://doi.org/10.1016/j.cjtee.2017.07.003

Please cite this article in press as: Wang X-J, et al., Quadratus femoris muscle pedicle bone flap transplantation in the treatment of femoral neck fracture for Chinese young and middle-aged patients: A systematic review and meta-analysis, Chinese Journal of Traumatology (2017), https://doi.org/10.1016/j.cjtee.2017.07.003

there is an increased risk of infection and nervi ischiadicus damage.[16] In addition, the surgeon will disturb the normal blood circulation of the medical circumflex femoral artery, which is the primary intraosseous vessels of the femoral head.[17] Therefore, some scholars persisted in using accurate reduction combining AO screw internal fixation for displaced femoral neck fractures in young patients. It is necessary to systematically review the two methods so as to make an optimal treatment protocol. The present study is to perform a meta-analysis including all the CCT studies in the last 10 years to determine whether there are any significant differences in terms of the fracture healing, good function of the hip joint, femoral head necrosis, and the time of fracture healing.

Materials and methods

Search strategy

We searched CCTs including randomized controlled study (RCT) and retrospective case study and compared the quadratus femoris muscle pedicle bone flap transplantation combining with hollow compression screw fixation and hollow compression screw fixation in the treatment of femoral neck fractures for Chinese young and middle-aged patients from Cochrane Library, Pubmed, CNKI, Chinese Biomedical Database, Wanfang Data published during the period of January 2005 to December 2014. The searched key words are *femoral neck fracture, quadratus femoris muscle pedicle bone flap, hollow compression screw fixation, and young patient*.

Inclusion criteria

The inclusion criteria were: (1) Chinese young adults with femoral neck fracture; (2) CCTs; (3) comparison of the quadratus femoris muscle pedicle bone flap transplantation combining with hollow compression screw fixation and hollow compression screw fixation for the treatment of femoral neck fractures; (4) the outcome being measured by the rate of fracture healing, the rate of good function of hip joint, the rate of femoral head necrosis, and the time of fracture healing.

Exclusion criteria

The exclusion criteria were: (1) case-based reports or reviews; (2) object of study and intervention measures failed to meet the inclusion criteria; (3) the original documents of experimental design being not precise; (4) studies with incomplete data.

Data extraction and quality assessment

Inclusion decisions were made independently by two reviewers according to the pre-stated eligible criteria. Disagreement in opinions between the two reviewers was resolved by discussion and a third reviewer was consulted as necessary. The criteria included seven items as follows: (1) whether to adopt the random sequence generation; (2) whether to use the principle of allocation concealment; (3) whether to use the principle of blinding for the subjects, implementers and measurement; (4) whether to use incomplete data and selective report; (5) whether there is any other bias. The relevant data recorded in this study included: first author's name, publishing year, sample size of quadratus femoris muscle pedicle bone flap transplantation combined with hollow compression screw fixation and hollow compression screw fixation, country of origin, duration of follow-up, the rate of fracture healing, the rate of good function of hip joint, the rate of femoral head necrosis, and the time of fracture healing.

Statistical analysis

Data were independently imput into the RevMan 5.0 Meta-analysis Software Program by two reviewers. Dichotomous outcomes were expressed in terms of Odds ratio (*OR*), and the weighted mean difference (*WMD*) was used for continuous outcomes, both with 95% confidence intervals (*CI*). Heterogeneity was tested by using the Chi-square test and the I^2 test. A fixed-effects model was chosen when there was no statistical evidence of heterogeneity and random-effect model was adopted if significant heterogeneity was found. If the heterogeneity was found, we checked the study population, treatment, outcome and methodologies to determine the source of heterogeneity. If it could not be quantitatively synthesized or had too low rate to be measured, we used qualitative evaluation. A funnel plot was applied to assess the presence of publication bias.

Results

A total of 325 potentially relevant articles were identified. After screening all the titles and abstracts, 277 studies were excluded. After reading all the full-text of 48 studies, 8 studies including 800 patients met all the inclusion criteria.[18–25] Quality was evaluated by the Newcastle-Ottava (NOS) score.[26] The total score is 10 points. Below 5 points is defined as low quality paper, while above 6 is regarded as medium quality paper, and above 8 is as high quality paper. Among them, there were 5 high quality papers and 3 medium quality papers (Table 1).

Rate of fracture healing

There was statistical difference between two groups [$OR = 5.43$, 95% *CI* (2.89, 10.20), $p < 0.05$, Fig. 1]. The results suggested that the rate of fracture healing was higher by using the transplantation of quadratus femoris muscle pedicle bone flap.

Rate of good function of hip joint

There was statistical difference between two groups [$OR = 5.43$, 95% *CI* (2.89, 10.20), $p < 0.05$, Fig. 2]. The results suggested that the rate of good function of hip joint was higher by using the transplantation of quadratus femoris muscle pedicle bone flap.

Rate of femoral head necrosis

There was statimoral hstical difference between two groups [$OR = 4.21$, 95% *CI* (2.02, 8.76), $p < 0.05$, Fig. 3]. The results suggested that the rate of femoral head necrosis was lower by using the transplantation of quadratus femoris muscle pedicle bone flap.

Time of fracture healing

There was statistical difference between two groups [$WMD = -46.85$, 95% *CI* (−65.13, −28.56), $p < 0.05$, Fig. 4]. The results suggested the time of fracture healing was shorter by using the transplantation of quadratus femoris muscle pedicle bone flap.

Publication bias

A strict quality assessment was carried out in the meta-analysis process. All the studies are CCT and the possibility of bias is low. But the funnel figure showed that there was a small bias, which might be associated with the incomplete collection of relevant literature, insufficient sample size and the different levels of clinical

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