SOCIEDADE BRASILEIRA DE ORTOPEDIA E TRAUMATOLOGIA

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Update Article

Bone graft in the treatment of nonunion of the scaphoid with necrosis of the proximal pole: a literature review☆

Antônio Lourenço Severo[a,*], *Marcelo Barreto Lemos*[a], *Osvandré Luiz Canfield Lech*[a], *Danilo Barreto Filho*[b,*], *Daniel Paulo Strack*[c], *Larissa Knapp Candido*[a]

[a] *Instituto de Ortopedia Traumatologia de Passo Fundo, Hospital do Trauma, Passo Fundo, RS, Brazil*
[b] *Hospital Universitário Dr. Miguel Riet Correa Jr., Rio Grande, RS, Brazil*
[c] *Centro de Especialidades de Ortopedia e Traumatologia, Ijuí, RS, Brazil*

ARTICLE INFO

Article history:
Received 5 September 2016
Accepted 10 November 2016
Available online 27 October 2017

Keywords:
Scaphoid bone
Osteonecrosis
Fracture nonunion
Bone transplantation

ABSTRACT

Scaphoid fractures are the most common fractures of the carpal bones, corresponding to 60%. Of these, 10% progress to nonunion; moreover, 3% can present necrosis of the proximal pole. There are various methods of treatment using vascularized and non-vascularized bone grafts.

To evaluate and compare the rate of scaphoid consolidation with necrosis of the proximal pole using different surgical techniques.

The authors conducted a review of the literature using the following databases: PubMed and BIREME/LILACS, where 13 case series were selected (ten with use of vascularized bone grafts and three of non-vascularized bone grafts), according to inclusion and exclusion criteria.

In most cases VBGs were used, especially those based on the 1,2 intercompartmental supraretinacular artery, due to greater reproducibility in performing the surgical technique.

Enxerto ósseo no tratamento da não consolidação do escafoide com necrose do polo proximal: revisão da literatura

Palavras-chave:
Osso escafoide
Osteonecrose
Fraturas não consolidadas
Transplante ósseo

RESUMO

As fraturas do escafoide são as mais comuns dos ossos do carpo, correspondem a 60%. Dessas, 10% evoluem para não consolidação; além disso, 3% podem apresentar necrose do polo proximal. Existem vários métodos de tratamento com enxertos ósseos, vascularizados e não vascularizados.

☆ Study conducted at the Instituto de Ortopedia e Traumatologia, Hospital do Trauma de Passo Fundo, Passo Fundo, RS, Brazil.

* *Corresponding authors.*
E-mails: antoniolsevero@gmail.com (A.L. Severo), drdanilo.cirurgiadamao@gmail.com (D. Barreto Filho).

http://dx.doi.org/10.1016/j.rboe.2016.11.011

Avaliar e comparar as taxas de consolidação do escafoide com necrose do polo proximal com diferentes técnicas cirúrgicas.

Fez-se uma revisão na literatura nas bases de dados PubMed e Bireme/Lilacs, das quais foram selecionadas 13 séries de casos (dez com uso de enxertos ósseos vascularizadose três enxertos ósseos não vascularizados), de acordo com os critérios de inclusão e exclusão.

Enxertos ósseos vascularizados foram usados na maioria dos casos, principalmente naqueles baseados na artéria intercompartimental suprarretinacular 1 e 2, devido à maior reprodutibilidade na técnica cirúrgica.

Introduction

Scaphoid fractures are most common fractures of the carpal bones, accounting for 60% of such fractures. Although consolidation can occur without the need for surgical treatment, some case series indicate nonunion rates of up to 10%.[1] Recent data suggest that the main risk factor for nonunion is fragment dislocation, which is associated with nonunion rates of up to 55%.[2]

Avascular necrosis has an estimated occurrence of 3% in all cases of scaphoid fractures; it occurs predominantly in the proximal pole, a fact attributed to the peculiar vascularization of this bone. Studies on the subject describe that the arterial supply of the scaphoid flows through three vessels (lateral volar, dorsal and distal), classified according to their spatial relation with the scaphoid.[3,4] More recently, some studies have shown the existence of two arteries: one completely dorsal and the second limited to the tubercle.[5]

For the diagnosis of avascular necrosis, the use of magnetic resonance imaging (MRI) has been recommended, which has an accuracy of up to 68%, increasing to 83% when associated with the use of gadolinium contrast. However, the gold standard is an intraoperative evaluation of the absence of bleeding in the proximal fragment.[6] Several treatment techniques have been described, with both vascularized (VBG) and non-vascularized (NVBG) bone grafts.

In a recent systematic review, Merrel et al.[7] concluded that the rate of consolidation of scaphoid fractures that evolved to nonunion was 88% in VBG *vs.* 47% in NVBG. In light of such data, this study aimed to perform an updated literature review on the rates of consolidation using the different types of grafts (VBG and NVBG) used for the treatment of nonunion of the scaphoid with necrosis of the proximal pole.

Methods

The current medical literature in the PubMed and BIREME/LILACS databases was searched using the following keyword combinations (Table 1)[8]:

1. Bone graft scaphoid
2. Non union scaphoid
3. Vascularized bone graft non union scaphoid
4. Cancellous bone graft scaphoid
5. Pseudoartrosis scaphoid

All articles that did not mention the use of bone grafts for the treatment of nonunion of the scaphoid, those that referred the use of immature skeletal graft, those that cited the use of bone grafts in other carpal pathologies, and those published over 20 years were excluded.

Thus, the following selection was obtained (Table 1).

All the articles that did not refer to avascular necrosis of the proximal pole were excluded.

Therefore, 13 articles were included.

Analysis of results

After a literature review, it was observed that in the last two decades there has been a tendency toward the use of VBG in cases of nonunion of the scaphoid, especially when there are signs of avascular necrosis of the proximal pole, the main indication for the use of these grafts.

The literature review evidenced the use of several VBG techniques, among them: VBG based on capsular circulation, VBG based on the metaphyseal circulation of the distal radius, VBG based on the volar circulation of the distal radius, VBG based on the 1,2 intercompartmental supraretinacular artery (1,2 ICSRA), and VBG originating from the femoral condyle and from the iliac crest (the latter made through microanastomosis on the radial artery). All techniques show high consolidation rates, with a mean of 89% (Table 2).

Steimann et al.[9] used the distal radius graft with the 1,2 ICSRA technique described by Zaindenberg; these authors achieved a consolidation rate of 100% in 44 cases treated with this technique. Of these, eight had proximal pole necrosis. Tsai et al.,[10] also using the 1,2 ICRSA technique, achieved consolidation rates of 80% (four out of five patients). Liang et al.[11] used the same technique as described above, obtaining a consolidation rate of 100%. Uerpairojkit et al.[12] also used the vascular graft technique based on the 1,2 ICRSA and achieved a consolidation rate of 100% in ten treated patients, five with necrosis of the proximal pole of the scaphoid (Table 2).

However, the study developed by Straw et al.,[13] in which a vascularized bone graft was also used based on the 1,2 ICSRA, presented consolidation rates well below those previously mentioned. That study obtained consolidation rates of only 27% in 22 cases of nonunion of the scaphoid; when