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Einsatz von Knochenersatzmaterialien bei Fusionen der Wirbelsäule

Zusammenfassung

Hintergrund

Die Rationale für den zunehmenden Einsatz von Knochenersatzmaterialien liegt in der Erhöhung des verfügbaren Graftvolumens, der Vermeidung der typischen Entnahmemorbidität von Autograft und der potentiell erhöhten Fusionsrate bei Revisionen und komplexen Eingriffen.

Fragestellung

Dem Anwender wird eine evidenzbasierte Hilfestellung bei der korrekten Auswahl und sicheren sowie effektiven Anwendung von Knochenersatzmaterialien geboten.

Material und Methoden

Der Beitrag stellt die evidenzbasierten Eigenschaften, Indikationsbereiche und Ergebnisse osteokonduktiver und induktiver Knochenersatzmaterialien dar.

Ergebnisse

Ein idealer Knochenersatz sollte analog zu autologem Knochen osteoinduktiv und konduktiv, apathogen, minimal antigen und – sofern erforderlich – mechanisch stabil sein. Bei Verwendung von Allograft sind die Vaskularisierungs- und Remodellierungsphasen gegenüber Autograft verzögert. Allogener Knochen, Allograft und demineralisierte Knochenmatrix (DBM) weisen eine limitierte Osteoinduktivität auf und können infektiöse Krankheiten übertragen. Plättchenreiches Plasma (PRP) und Knochenmarkaspirat sind osteoinduktiv und werden üblicherweise im Verbund mit osteokonduktiven Trägermaterialien eingesetzt. „Bone morphogenic proteins“ (BMP) sind derzeit für mono- oder bisegmentale anteriore lumbale Fusionen zugelassen. Die Fusionsraten mit BMP entsprechen denen autologer Spongiosa. BMP haben spezifische Nebenwirkungen (Wundkomplikationen, Radikulitis) und erhöhen möglicherweise das Krebsrisiko. Osteokonduktive Keramiken (Hydroxylapatit, Calciumcarbonat, Calciumsulfat, β -Tricalciumphosphat) eignen sich als Graftextender und Träger für Osteoinduktiva und Antibiotika.

Diskussion

Zur Aufstockung von Autograft stehen Biokeramiken zur Verfügung, die sich durch unterschiedliche mechanische und biologische Eigenschaften auszeichnen. Bei anterioren Fusionseingriffen [anteriore zervikale Diskektomie mit Fusion (ACDF), anteriore lumbale interkorporelle Fusion (ALIF)] ist mit Graftextendern eine befriedigende Fusionsrate (> 90 %) zu erreichen, während deren alleiniger Einsatz bei posterolateralen Fusionen nicht empfohlen wird. Als Knochenersatz stehen BMP zur Verfügung. Diese sollten bei definierten Sonderindikationen (komplexe Revisionseingriffe, Pseudarthrosen) eingesetzt werden.

Abstract

Background

The rationale for the increasing use of bone graft replacement lies in the need for increased graft volume, the avoidance of typical autograft donor site morbidity, and the potential improvement of fusion rates in revision and complex reconstructive surgery.

Objectives

The purpose of this work is to offer the spinal surgeon an evidence-based guide for choosing the appropriate grafting material and for using it effectively.

Material and methods

Evidence-based overview of physical and biological properties, clinical indications and results of osteoconductive and osteoinductive bone replacement materials.

Results

The ideal bone replacement material should be osteoinductive and conductive, non-pathogenic, minimally antigenic, and (if required) mechanically stable. Compared to autograft, vascularization and remodeling of the fusion mass are delayed using allograft. Allogenous bone and demineralized bone matrix (DBM) possess limited osteoinductive properties and carry the risk of potential infectious disease transmission. Plasma-rich plasma (PRP) and bone marrow aspirate are commonly used in conjunction with an osteoconductive carrier materials. On-label use of bone morphogenetic proteins (BMPs) is currently restricted to mono- and bisegmental anterior lumbar fusion. The fusion rates obtained with BMPs match those of autologous bone graft. Potential risks of rhBMP in clinical use include soft tissue reactions, radiculitis and potentially increased risk of cancer. Osteoconductive ceramics (HA, CC, CS, β -TCP) are useful graft extenders and carriers for bone growth enhancers and antibiotics.

Conclusions

Osteoconductive bioceramics with different mechanical and biological properties are available for use as graft extenders. In a defined group of anterior interbody fusion procedures (ACDF, ALIF), satisfactory fusion rates (> 90 %) may be obtained with exclusive use of graft extenders, whereas their solitary use in posterolateral fusions is not advisable. Genuine bone replacement is currently feasible with BMPs. Their use should be restricted to specific indications such as complex revision surgery and pseudarthrosis.



Article Metrics

Citations

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Authors

- K.-M. Scheufler ⁽¹⁾
- D. Diesing ⁽¹⁾

Author Affiliations

- 1. Regionales Wirbelsäulenzentrum Kempen-Moers, Hospital zum Heiligen Geist Kempen GmbH, Von-Broichhausen-Allee 1, 47906, Kempen, Deutschland



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