Sports Medicine, Orthopedics & Pain Management

Amniotic Fluid Cell Therapy to Relieve Disc-Related Low Back Pain and Its Efficacy Comparison with Long-Acting Steroid Injection

Introduction: There are many problems in cases of treatment for patients reporting degenerated disc with or without disc prolapse, desiccation, bulge, or compression of the adjacent nerves and its implications. Most of the patients with chronic discogenic back pain, without specific history of trauma, are of the geriatric age group. In this age group, low back pain is associated with varying degree of age-induced degenerative osteoporosis, spondylosis, spondyloarthrosis, intervertebral disc prolapse, or even compression collapse apart from other problems like: diabetic background, hypertension, ischemic heart disease, chronic obstructive pulmonary disease, dyslipidemia, and hypothyroidism. For MRI presentation of typical geriatric low back pain, see Figs. 19.1, 19.2, and 19.3. Materials and methods: 42 patients participated and randomized in two equal groups. Group A (N = 21, male 10 and female 11, mean age 56.4 ± 8.9 year) was treated with 80 mg methylprednisolone in 10 mL water for injection under C-arm guidance in the operation theater (OT) after 1 % infiltration with Xylocaine at the site of maximum tenderness in the back. Similarly, Group B (N = 21, male 12 and female 9, mean age 59.4 ± 6.4 year) was also treated in the OT under similar protocol with 10 mL of freshly collected amniotic fluid from mothers undergoing hysterectomy and ligation. All of the procedures passed through the donor and recipient's informed consent protocol and vetted by the institute-based ethical committee. Result and analysis: Studying and comparing the clinically manifested effect of treatment, it can be easily seen that both steroid (Group A) and cell therapy (Group B) patients showed reduction of pain and distress from the pretreatment value; however, Group B scoring is much better (p, 0.01), as seen and assessed from the value of the VAS (visual analog pain scale), WD (walking distance in meters), and HAQ (Health Assessment Questionnaire). Looking further, the clinical assessment of pain relief and patient's satisfaction as seen from Table 19.3 and Graph 19.1 in case of Group A (long-acting steroid group), it was 20/21 cases in 1st month which became 12/21 in 3rd month, 6/21 in 6th month, 4/21 in 12th month, and 2/21 after 24-month follow-up. Similarly, in Group B (cell therapy patients), the identical values after the 1st month were 18/21, which became 21/21 in 3rd month, 21/21 in 6th month, 14/21 in 12th month, and 12/24 after 24-month follow-up. Another globally practiced guideline for pain assessment or scoring for comparison is the Oswestry low back pain disability questionnaire. Here in Table 19.4 and Graph 19.2, we have again compared the effect of the treatment of Group A (steroid) and Group B (cell therapy with fresh amniotic fluid) and followed up the results of Group A and Group B treatment as per scoring by Oswestry low back pain disability questionnaire up to 24 months. Here, post injection with long-acting steroid (Group A) suggested a mean scoring of 9 ± 1.2 % SD after 3 months, which became mean 1.9 ± 1.2 % SD after 6 months, mean 39 ± 9.2 % SD after 9 months, mean 39 ± 8.2 % SD after 12 months, mean 41 ± 7.2 % SD after 18 months, and then ultimately mean 48 ± 12.2 % SD after 24 months. Similarly, in case of cell therapy group (Group B), the mean scoring was 11.7 ± 1.6 % SD after 3rd month follow-up, which became mean 9.4 ± 0.6 % SD after 6th month, mean 9.1 ± 0.96 % SD after 9th month, mean 7.1 ± 0.6 % SD after 12th month, mean 6.7

± 0.4 % SD after 18th month, and ultimately mean 4.1 ± 0.96 % SD after 24th month follow-up.

Discussion and conclusion: If we analyze the results, we can see long-acting steroid, due to its anti-inflammatory and other activities, causes some improvement of the patients; however, it is ill sustained as noted from the follow-up. Freshly collected simple amniotic fluid cell therapy has a much more sustained effect apart from the remarkable improvement, but the question remains why in long-term follow-up there is reappearance of pain in some of the patients』 Is it psychosomatic aspects, a recurrent cell therapy, or increasing the cell dosage that can have a more sustained effect』 These are some of the questions for the future investigators in this frontline area of cellular therapy, but from an overall point of view, regeneration can only treat the root cause of degeneration of the whole lumbosacral region. Cell therapy is the only curative approach for such a generalized multisystemic deterioration of the region, and the palliative approach of pain relief with anti-inflammatory drug including steroid is short lived and has longtime use and may lead to drug-induced problems in addition to the recurrence of the symptoms.

Bhattacharya, Niranjan. (2012, December 5). Human Fetal Tissue Transplantation. Amniotic Fluid Cell Therapy to Relieve Disc-Related Low Back Pain and Its Efficacy comparison with Long-Acting Steroid Injection. 2013, pp 251-264

Amniotic Fluid Stem Cells: a Promising Therapeutic Resource for Cell-Based Regenerative Therapy

Stem cells have been proposed as a powerful tool in the treatment of several human diseases, both for their ability to represent a source of new cells to replace those lost due to tissue injuries or degenerative diseases, and for the ability of produce trophic molecules able to minimize damage and promote recovery in the injured tissue. Different cell types, such as embryonic, fetal or adult stem cells, human fetal tissues and genetically engineered cell lines, have been tested for their ability to replace damaged cells and to restore the tissue function after transplantation. Amniotic fluid -derived Stem cells (AFS) are considered a novel resource for cell transplantation therapy, due to their high renewal capacity, the "in vitro" expression of embryonic cell lineage markers, and the ability to differentiate in tissues derived from all the three embryonic layers. Moreover, AFS do not produce teratomas when transplanted into animals and are characterized by a low antigenicity, which could represent an advantage for cell transplantation or cell replacement therapy. The present review focuses on the biological features of AFS, and on their potential use in the treatment of pathological conditions such as ischemic brain injury and bone damages.

Antonucci, I., Pantalone, A., Tete, S., Salini, V., Borlongan, C., Hess, D., & Stuppia, L. (2012). Amniotic fluid stem cells: A promising therapeutic resource for cell-based regenerative therapy. Current Pharmaceutical Design, 18(13), 1846-1863.

Mesenchymal stem cells in arthritic diseases

Mesenchymal stem cells (MSCs), the nonhematopoietic progenitor cells found in various adult tissues, are characterized by their ease of isolation and their rapid growth in vitro while maintaining their differentiation potential. This allows for extensive culture expansion to obtain large quantities suitable for therapeutic use. These properties make MSCs an ideal candidate cell type as building blocks for tissue engineering efforts to regenerate replacement tissues and repair damaged structures as encountered in various arthritic conditions. Osteoarthritis (OA) is the most common arthritic condition and, like rheumatoid arthritis (RA), presents an inflammatory environment with immunological involvement. This has been an enduring obstacle that can potentially limit the use of cartilage tissue engineering. Recent advances in our understanding of the functions of MSCs have shown that MSCs also possess potent immunosuppression and anti-inflammation effects. In addition, through secretion of various soluble factors, MSCs can influence the local tissue environment and exert protective effects with an end result of effectively stimulating regeneration in situ. This function of MSCs can be exploited for their therapeutic application in degenerative joint diseases such as RA and OA. This review surveys the advances made in the past decade which have led to our current understanding of stem cell biology as relevant to diseases of the joint. The potential involvement of MSCs in the pathophysiology of degenerative joint diseases will also be discussed. Specifically, we will explore the potential of MSC-based cell therapy of OA and RA by means of functional replacement of damaged cartilage via tissue engineering as well as their anti-inflammatory and immunosuppressive activities.

Chen, F. H., & Tuan, R. S. (2008). Mesenchymal stem cells in arthritic diseases. Arthritis Research & Therapy, 10(5), 223-223. doi:10.1186/ar2514

Amniotic fluid-derived stem cells in regenerative medicine research

The stem cells isolated from amniotic fluid present an exciting possible contribution to the field of regenerative medicine. Amniotic fluid-derived stem (AFS) cells have significant potential for research and therapeutic applications. AFS cells are multipotent, showing the ability to differentiate into cell types from all three embryonic germ layers. They express both embryonic and adult stem cell markers, expand extensively without feeder cells, double in 36 h, and are not tumorigenic. The AFS cells can be maintained for over 250 population doublings and preserve their telomere length and a normal karyotype. They differentiate easily into specific cell lineages and do not require human embryo tissue for their isolation, thus avoiding the current controversies associated with the use of human embryonic stem (ES) cells. The discovery of the AFS cells has been recent, and a great deal of work remains to be performed on the characterization and use of these cells. This review describes the various differentiated lineages that AFS cells can form and the future of these promising new stem cells in regenerative medicine research.

Joo, S., Ko, I. K., Atala, A., Yoo, J. J., & Lee, S. J. (2012). Amniotic fluid-derived stem cells in regenerative medicine research. Archives of Pharmacal Research, 35(2), 271-280. doi:10.1007/s12272-012-0207-7

Mesenchymal Stromal Cells in Rheumatoid Arthritis: Biological Properties and Clinical Applications

Mesenchymal stromal cells (MSC) isolated from a variety of adult tissues including the bone marrow (BM), have the capacity to differentiate into different cell types such as bone and cartilage and have therefore attracted scientific interest as potential therapeutic tools for tissue repair. MSC display also immunosuppressive and anti-inflammatory properties and their putative therapeutic role in a variety of inflammatory autoimmune diseases is currently under investigation. Joint destruction, caused by persistent inflammation, renders rheumatoid arthritis (RA) a possible clinical target for cartilage and bone repair using BM MSCs for their tissue repair and immunoregulatory effects. A number of studies, based mainly on experimental animal models, have recently provided interesting data on the potential of BM-MSCs to suppress local inflammation and tissue damage in RA whereas tissue engineering and cell-scaffold technology represents an emerging field of research. This review deals with the biological repair/regeneration of joint tissues in RA via MSC-based therapies. In view of the current interest in the autologous usage of BM MSC in RA, all available data on the biological properties of patient MSCs including the immunoregulatory characteristics, differentiation capacity towards osteocytes/chondrocytes, clonogenic/proliferative potential and molecular/protein profile and the possible influence of the RA milieu will be also summarized.

Kastrinaki, M., & Papadaki, H. (2009). Mesenchymal stromal cells in rheumatoid arthritis: Biological properties and clinical applications. CURRENT STEM CELL RESEARCH & THERAPY, 4(1), 61-69. doi:10.2174/157488809787169084

Local Adherent Technique for Transplanting Mesenchymal Stem Cells as a Potential Treatment of Cartilage Defect

Introduction Current cell therapy for cartilage regeneration requires invasive procedures, periosteal coverage and scaffold use. We have developed a novel transplantation method with synovial mesenchymal stem cells (MSCs) to adhere to the cartilage defect. Methods For ex vivo analysis in rabbits, the cartilage defect was faced upward, filled with synovial MSC suspension, and held stationary for 2.5 to 15 minutes. The number of attached cells was examined. For in vivo analysis in rabbits, an autologous synovial MSC suspension was placed on the cartilage defect, and the position was

maintained for 10 minutes to adhere the cells to the defect. For the control, either the same cell suspension was injected intra-articularly or the defects were left empty. The three

groups were compared macroscopically and histologically. For ex vivo analysis in humans, in addition to the similar experiment in rabbits, the expression and effects of neutralizing antibodies for adhesion molecules were examined. Results Ex vivo analysis in rabbits demonstrated that the number of attached cells increased in a time-dependent manner, and more than 60% of cells attached within 10 minutes. The in vivo study showed that a large number of transplanted synovial MSCs attached to the defect at 1 day, and the cartilage defect improved at 24 weeks. The histological score was consistently better than the scores of the two control groups (same cell suspension injected intra-articularly or defects left empty) at 4, 12, and 24 weeks. Ex vivo analysis in humans provided similar results to those in rabbits. Intercellular adhesion molecule 1-positive cells increased between 1 minute and 10 minutes, and neutralizing antibodies for intercellular adhesion molecule 1, vascular cell adhesion molecule 1 and activated leukocyte-cell adhesion molecule inhibited the attachment. Conclusion Placing MSC suspension on the cartilage defect for 10 minutes resulted in adherence of >60% of synovial MSCs to the defect, and promoted cartilage regeneration. This adherent method makes it possible to adhere MSCs with low invasion, without periosteal coverage, and without a scaffold.

Koga, H., Shimaya, M., Muneta, T., Nimura, A., Morito, T., Hayashi, M., . . . Sekiya, I. (2008). Local adherent technique for transplanting mesenchymal stem cells as a potential treatment of cartilage defect. Arthritis Research & Therapy, 10(4), R84-R84. doi:10.1186/ar2460

Human Amnion Tissue Injected with Human Umbilical Cord Mesenchymal Stem Cells Repairs Damaged Sciatic Nerves in Rats

Human umbilical cord mesenchymal stem cells, incorporated into an amnion carrier tubes, were assessed for nerve regeneration potential in a rat nerve defect model. Damaged nerves were exposed to human amnion carriers containing either human umbilical cord mesenchymal stem cell (cell transplantation group) or saline (control group). At 8, 12, 16 and 20 weeks after cell implantation, the sciatic functional index was higher in the cell transplantation group compared with the control group. Furthermore, electrophysiological examination showed that threshold stimulus and maximum stimulus intensity gradually decreased while compound action potential amplitude gradually increased. Hematoxylin-eosin staining showed that regenerating nerve fibers were arranged in nerve tracts in the cell transplantation group and connective tissue between nerve tracts and amnion tissue reduced over time. Gastrocnemius muscle cell diameter, wet weight and restoration ratio were increased. These data indicate that transplanted human umbilical cord mesenchymal stem cells, using the amnion tube connection method, promote restoration of damaged sciatic nerves in rats.

Li, D., Wang, C., Shan, W., Zeng, R., Fang, Y., & Wang, P. (2012). Human amnion tissue injected with human umbilical cord mesenchymal stem cells repairs damaged

sciatic nerves in rats. NEURAL REGENERATION RESEARCH, 7(23), 1771-1778. doi:10.3969/j.issn.1673-5374.2012.23.002

Tendon Regeneration and Repair with Stem Cells

The use of stems cells in tendon repair is of particular interest given the frequency of tendon injuries worldwide together with the technical difficulty often encountered when repairing or augmenting tendons. Stems cells have the capability to differentiate into a variety of different cell types including osteocytes and tenocytes, and if normal architecture of damaged tendon (either macroscopic or microscopic) could be restored, this would significantly improve the management of patients with these injuries. There is already encouraging research on the use of stems cells clinically although considerable further work is required to improve knowledge and clinical applications of stem cells in tissue engineering.

MacLean, S., Khan, W. S., Malik, A. A., Snow, M., & Anand, S. (2012). Tendon regeneration and repair with stem cells. Stem Cells International, 2012, 316281. doi:10.1155/2012/316281

Effects of Human Amniotic Fluid on Cartilage Regeneration From Free Perichondrial Grafts in Rabbits

After the chondrogenic potential of free grafts of perichondrium was shown in several experimental studies, perichondrium has been used to reconstruct cartilage tissue in various clinical situations. This study investigates the effects of human amniotic fluid on neochondrogenesis from free perichondrial grafts in a rabbit model. Since this fluid contains high concentrations of hyaluronic acid, hyaluronic acid-stimulating activator, growth factors, and extracellular matrix precursors during the second trimester, it may have a stimulating effect on neochondrogenesis. Perichondrial grafts, measuring 20x20 mm super(2) were obtained from the ears of 144 New Zealand young rabbits and were sutured over the paravertebral muscles. The rabbits were randomly divided into three groups with 48 rabbits per group. In group 1, 0.3 ml human amniotic fluid, and in group 2, 0.3 ml saline were injected underneath the perichondrial grafts. Group 3 formed the control group in which no treatment was given. Histologically, neochondrogenesis was evaluated in terms of cellular form and graft thickness at 2, 4, 6, and 8 weeks after surgery. In group 1, the mature cartilage was generated quickly and the cartilage plate in this group was significantly thick

and extensive when compared with groups 2 and 3 at 8 weeks ($p<0.05$, ANOVA). In conclusion, our study shows that human amniotic fluid enhances neochondrogenesis from free perichondrial grafts. The rich content of hyaluronic acid and growth factors possibly participate in this result.

Ozgenel, G. Y., Filiz, G., & Ozcan, M. (2004). Effects of human amniotic fluid on cartilage regeneration from free perichondrial grafts in rabbits. British Journal of Plastic Surgery, 57(5), 423-428. doi:10.1016/j.bjps.2003.12.021

Meniscal Tears Respond to Cell Injections

Vangsness reported that a few patients in the low-dose MSC group also showed evidence of meniscal regeneration in MRI scans taken after one year.

Young, B. (2012) Meniscal Tears Respond to Cell Injections. ORTHOPEDICS THIS WEEK. Retrieved from Single Source Surgical: http://www.singlesourcesurgical.com/wp-content/uploads/2014/01/amniotic-tissue.pdf

Platelet-Rich Plasma Therapy - Future or Trend?

Chronic complex musculoskeletal injuries that are slow to heal pose challenges to physicians and researchers alike. Orthobiologics is a relatively newer science that involves application of naturally found materials from biological sources (for example, cell-based therapies), and offers exciting new possibilities to promote and accelerate bone and soft tissue healing. Platelet-rich plasma (PRP) is an orthobiologic that has recently gained popularity as an adjuvant treatment for musculoskeletal injuries. It is a volume of fractionated plasma from the patient's own blood that contains platelet concentrate. The platelets contain alpha granules that are rich in several growth factors, such as platelet-derived growth factor, transforming growth factor-β, insulin-like growth factor, vascular endothelial growth factor and epidermal growth factor, which play key roles in tissue repair mechanisms. PRP has found application in diverse surgical fields to enhance bone and soft-tissue healing by placing supra-physiological concentrations of autologous platelets at the site of tissue damage. The relative ease of preparation, applicability in the clinical setting, favorable safety profile and possible beneficial outcome make PRP a promising therapeutic approach for future regenerative treatments. However, there is a large knowledge gap in our understanding of PRPs mechanism of action, which has raised skepticism regarding its potential efficacy and use. Thus, the aim of this review is to describe the various factors proposed to contribute to the biological activity of PRP, and the published pre-clinical and clinical evidence to support it. Additionally, we describe the current techniques and

technology for PRP preparation, and review the present shortcomings of this therapy that will need to be overcome if it is to gain broad acceptance.

Dhillon, R. S., Schwarz, E. M., & Maloney, M. D. (2012). Platelet-rich plasma therapy - future or trend? Arthritis Research & Therapy, 14(4), 219-219. doi:10.1186/ar3914

Human Stem Cell Delivery for Treatment of Large Segmental Bone Defects

Local or systemic stem cell delivery has the potential to promote repair of a variety of damaged or degenerated tissues. Although various stem cell sources have been investigated for bone repair, few comparative reports exist, and cellular distribution and viability post implantation remain key issues. In this study, we quantified the ability of tissue-engineered constructs containing either human fetal or adult stem cells to enhance functional repair of nude rat critically sized femoral defects. After 12 weeks, defects treated with cell-seeded polymer scaffolds had significantly higher bone ingrowth and torsional strength compared to those receiving acellular scaffolds, although there were no significant differences between the cell sources. Next, stem cells were labeled with fluorescent quantum dots (QDs) in an attempt to noninvasively track their distribution after delivery on scaffolds. Clear fluorescence was observed at implantation sites throughout the study; however, beginning 7-10 days after surgery, signals were also observed at contralateral sites treated with acellular QD-free scaffolds. Although immunostaining for human nuclei revealed retention of some cells at the implantation site, no human cells were detected in the control limb defects. Additional histological analysis of implantation and control defect tissues revealed macrophages containing endocytosed QDs. Furthermore, QD-labeling appeared to diminish transplanted cell function resulting in reduced healing responses. In summary, augmentation of polymeric scaffolds with stem cells derived from fetal and adult tissues significantly enhanced healing of large segmental bone defects; however, QD labeling of stem cells eliminated the observed therapeutic effect and failed to conclusively track stem cell location long-term in vivo.

Dupont, K. M., Sharma, K., Stevens, H. Y., Boerckel, J. D., García, A. J., & Guldberg, R. E. (2010). Human stem cell delivery for treatment of large segmental bone defects. Proceedings of the National Academy of Sciences, 107(8), 3305-3310. doi:10.1073/pnas.0905444107

Metabolic Functions of Myostatin and GDF11

Myostatin is a member of the transforming growth factor β superfamily of secreted growth factors that negatively regulates skeletal muscle size. Mice null for the myostatin

gene have a dramatically increased mass of individual muscles, reduced adiposity, increased insulin sensitivity, and resistance to obesity. Myostatin inhibition in adult mice also increases

muscle mass which raises the possibility that anti-myostatin therapy could be a useful approach for treating diseases such as obesity or diabetes in addition to muscle wasting diseases. In this review I will describe the present state of our understanding of the role of myostatin and the closely related growth factor growth/differentiation factor 11 on metabolism.

Genetics of Development and Disease Branch, National Institute of Diabetes and Digestive and Kidney Diseases, National Institutes of Health, Bethesda, Maryland USA.(2010) Metabolic Functions Of Myostatin AND GDF11. Immunol Endocr Metab Agents Med Chem. 2010 Dec;10(4):217-231.

Potential Applications for Using Stem Cells in Spine Surgery

While the use of biologics as adjuncts for spine surgery is growing annually stem cells have yet to be approved for this clinical application. Stem cells have the unique ability to differentiate into a variety of musculoskeletal tissues including bone or cartilage. Moreover they have been shown to secrete growth factors that promote matrix repair and regeneration and can down regulate inflammation and immune cell functions. It is these combined activities that make stem cells attractive candidates for advancing current techniques in spine surgery and possibly mitigating those pathologies responsible for tissue degeneration and failure thereby minimizing the need for surgical intervention at a later date. This review focuses on the characteristics of progenitor cells from different sources and explores their potential as adjuncts for both current and future applications in spine surgery. Where possible we draw on the experimental outcomes from our own preclinical studies using adult mesenchymal progenitor stem cells, as well as related studies by others to support our contention that stem cell based therapies will play a significant role in spine surgery in the future.

Regenerative Processing Plant, LLC

Goldschlager, T., Jenkin, G., Ghosh, P., Zannettino, A., & Rosenfeld, J. (2010). Potential applications for using stem cells in spine surgery. CURRENT STEM CELL RESEARCH & THERAPY, 5(4), 345-355. doi:10.2174/157488810793351686

Initial Clinical Experience with The Use of Human Amniotic Membrane Tissue During Repair of Posterior Tibal and Achilles Tendon

The demonstrated anti-adhesive, anti-inflammatory and anti-microbial properties of amniotic membrane tissue make this a potentially unique alternative to biologically inert

collagen matrix products currently available for use in foot and ankle surgery and possible for tendon repair surgery of the upper extremities.

Jay, R. (n.d.). Amniotic Tissue. Retrieved from Single Source Surgical: http://www.singlesourcesurgical.com/wp-content/uploads/2014/01/amniotic-tissue.pdf

Applying Stem Cells to Orthopaedic Conditions: using bone marrow stromal cells to treat nonunions and osteonecrosis

... of infection, makes stem cell therapy appealing to both patients and physicians. Although not yet widespread in orthopedics, the use of adult stem cells to address...

Kelly, F. B., & Porucznik, M. A. (2014). Applying stem cells to orthopedic conditions: Using bone marrow stromal cells to treat nonunion and osteonecrosis. AAOS Now, , 1.

Effects of Human Amniotic Fluid on Fracture Healing in Rat Tibia

Human amniotic fluid (HAF), including hyaluronic acid (HA) and several growth factors, has been used experimentally in tendon, nerve, and cartilage regeneration and in bone defects because of its positive stimulating effects on regeneration potential. This study was performed to investigate whether HAF was effective on fracture healing.

Kerimoğlu, S., Livaoğlu, M., Sönmez, B., Yuluğ, E., Aynacı, O., Topbas, M., & Yarar, S. (2009). Effects of human amniotic fluid on fracture healing in rat tibia. Journal of Surgical Research, 152(2), 281-287. doi:10.1016/j.jss.2008.02.028

Summary of Clinical Outcome Related to The Use of Human Amnion Soft Tissue Allograft in Right L4-L5 Decompression Procedure

The use of the nonadherent barrier significantly reduced both scar tissue formation and adherence to the underlying dura in this patient. The lack of scar tissue and associated

plane preservation between the dural sac and the surrounding soft tissue significantly decreased the operative time required to perform the revision procedure.

Ploska, P. (2010) Summary of Clinical Outcome Related to The Use of Human Amnion Soft Tissue Allograft in Right L4-L5 Decompression Procedure. Retrieved from Single Source Surgical: http://www.singlesourcesurgical.com/wp-content/uploads/2014/01/amniotic-tissue.pdf

Implantation of Amniotic Membrane to Reduce Post laminectomy Epidural Adhesions

Postlaminectomy epidural adhesion is implicated as a main cause of "failed back surgery syndrome" and associated with increased risk of complications during revision surgery. Various materials acting as mechanical barriers to reduce fibroblasts infiltration into epidural space have met with limited success. In present research, amniotic membrane (AM) was studied to investigate its effects on reducing epidural scar adhesion after laminectomy in a canine model. Laminectomy sites were created at L-1, L-3, L-5, and L-7 levels in 24 adult mongrel dogs. Freeze dried AM (FAM), cross-linked AM (CAM), and autologous free fat (AFF) were implanted, respectively, at a randomly assigned site in each dog with the remaining untreated site serving as internal control. The animals were sacrificed at 1, 6, and 12 weeks postoperatively. Then, gross pathologic observation including scar amount and adhesion tenacity, qualitative histology evaluation, and quantitative histology analysis were compared. Gross observation demonstrated that scar amount and adhesion tenacity of CAM group were significantly lower in comparison with those of FAM and non-treatment groups. A white, slightly vascularized CAM layer covered the dura mater without tenacious scar adhesion. The histology analysis also indicated reduced fibroblasts infiltration and consequent epidural fibrosis, which were similar to the results of AFF group. In conclusion, the CAM is effective in reducing epidural fibrosis and scar adhesion after laminectomy in canine model. It is a promising biomaterial for future clinical applications.

Tao, H., & Fan, H. (2009). Implantation of amniotic membrane to reduce postlaminectomy epidural adhesions. European Spine Journal : Official Publication of the European Spine Society, the European Spinal Deformity Society, and the European Section of the Cervical Spine Research Society, 18(8), 1202-1212. doi:10.1007/s00586-009-1013-x

Mesenchymal Stem Cells for Bone Repair and Metabolic Bone Diseases

Human mesenchymal stem cells offer a potential alternative to embryonic stem cells in clinical applications. The ability of these cells to self-renew and differentiate into multiple tissues, including bone, cartilage, fat, and other tissues of mesenchymal origin, makes them an attractive candidate for clinical applications. Patients who experience fracture nonunion and metabolic bone diseases, such as osteogenesis imperfecta and hypophosphatasia, have benefited from human mesenchymal stem cell therapy. Because of their ability to modulate immune responses, allogeneic transplant of these cells may be feasible without a substantial risk of immune rejection. The field of regenerative medicine is still facing considerable challenges; however, with the progress achieved thus far, the promise of stem cell therapy as a viable option for fracture nonunion and metabolic bone diseases is closer to reality. In this review, we update the biology and clinical applicability of human mesenchymal stem cells for bone repair and metabolic bone diseases.

Undale, A. H., Westendorf, J. J., Yaszemski, M. J., & Khosla, S. (2009). Mesenchymal stem cells for bone repair and metabolic bone diseases. Mayo Clinic Proceedings, 84(10), 893-902. doi:10.4065/84.10.893

Birth Tissue/Ankle Tendon Repair Study Released

The white, slightly vascularized membrane was found between the dura matter and surrounding tissues to reduce scar intrusion. Furthermore, the CAM layer seldom adhered to the dura mater and was easily removed.
Regenerative Processing Plant, LLC

Young, R. (2012) Birth Tissue/Ankle Tendon Repair Study Released. ORTHOPEDICS THIS WEEK - EXTREMITIES. Retrieved from Single Source Surgical: http://www.singlesourcesurgical.com/wp-content/uploads/2014/01/amniotic-tissue.pdf

Using Birth Tissue in Spine Surgery

Fascia is one of the most important covering materials in the body and serves to protect virtually every structure in the body—bones, nerves, muscles, tendons, organs, the spinal cord and the brain. So when trauma or surgery disrupts that natural, protective fascia covering, amniotic membranes are structurally and by composition, extremely similar if not precise transplants

Young, R. (2012, August 20). Using Birth Tissues in Spine Surgery. Retrieved from Orthopedics This Week: http://ryortho.com/2012/08/using-birth-tissues-in-spine-surgery/

Dentistry

Stem cell therapy in oral and maxillofacial region: An overview

http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3303525/

Human amniotic fluid stem cells as an attractive tool for clinical applications.

http://www.ncbi.nlm.nih.gov/pubmed/23140502

Human amniotic fluid-derived and dental pulp-derived stem cells seeded into collagen scaffold repair critical-size bone defects promoting vascularization.

http://www.ncbi.nlm.nih.gov/pubmed/23688855

Osteogenic differentiation of amniotic fluid mesenchymal stromal cells and their bone regeneration potential

http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4444609/

Amnion membrane for coverage of gingival recession: A novel application

http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4147801/