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AUTOLOGOUS BONE MARROW COATED MESH IN REPAIR OF INCISIONAL HERNIA: A QUASI-EXPERIMENTAL STUDY

General Surgery

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ABSTRACT

Introduction: Abdominal incisional hernia is one of the most common postoperative complications after laparotomy. Recurrent incisional hernia can be complicated by enterocutaneous fistula, bowel obstruction, surgical site infection etc. Given this recent studies we have concentrated on improving prosthetic biocompatibility such as coating mesh with the patient's own bone marrow cells to reduce mesh related complications and for strong repair.

Methods: Bone marrow harvested from sternum and strored in a sterile specican with heparin. Separation of different components of incisional hernia done. Peritoneum is dissected from posterior rectus sheath 5cm beyond the neck of sac and around. Bone marrow is then coated over mesh in both side. Then mesh is placed preperitoneal space and fixation done. Abdomen closed in later with a drain.

Discussion: bonemarrow coated mesh may improve biocompatibility, by reducing inflammation and adhesion formation and improve the quality and strength of the regenerated tissue.

Conclusion: Bone marrow coated mesh repair is a better modality of treatment in decreasing morbidity as compared to conventional hernia mesh repair surgery.

KEYWORDS

autologous bone marrow, bone marrow coated mesh, prosthetic biocompatibility, incisional hernia.

INTRODUCTION:

Incisional hernias are result of common complication of abdominal midline incision and wound dehiscence. Once patient developes such a hernia, they are at risk for recurrent hernia formation via the same wound even after repair , and the best mesh for incisional hernia is yet to be discovered. The best surgical techniques for years have not answered to this question. At the present more than hundred surgical meshes are available in the market, however the ideal mesh does not yet exist and still needs to be developed. Postoperative complications like seroma formation, adhesion, enterocutaneous fistula, surgical site infection and recurrence still occurs despite advancement in prosthetic technology. In this recent scientific study we have concentrated on improving prosthetic biocompatibility such as coating mesh with the patient's own bone marrow cells to reduce mesh related complications and for a strong repair.

OBJECTIVE:

GENERAL-

- To compare the effectiveness of bone marrow cell coated mesh repair with conventional mesh repair in incisional hernia.

PRIMARY-

To compare the

1. Postoperative complications.
2. Morbidity
3. Recurrence

Of autologous bone marrow coated mesh with conventional mesh repair in incisional hernia.

METHODS:

Institutional ethics committee clearance and informed consent of the patients was taken before the study. 30 patients with incisional hernia underwent mesh repair at VSS Institute of Medical Sciences and Research, Burla, Odisha, India during June 2017-february 2019, out of which 15 patients were kept in study group and rest 15 in control group. Preperitoneal mesh repair was performed in all patients both study and control group.

INCLUSION CRITERIA:

All incisional hernia admitted to VSSIMSAR , BURLA with defect size >4 cm

EXCLUSSION CRITERIA:

Patients with co morbidity condition like diabetes mellitus, pregnant ladies, immunocompromised person, children and mentally retard person.

In study group bone marrow was aspirated from sternum and immediately stored in a sterile specican with heparin (10:1) . incisional hernia dissected in layer and separation of different components done. Then separation of peritoneum from posterior rectus sheath 5cm beyond the sac and around. Then separated peritoneum closed over viscera. Bone marrow is then coated on both side of the mesh and the bone marrow coated mesh is placed in preperitoneal space covering the defect. Then mesh is fixed in usual manner and lastly abdomen layer are closed with a drain.

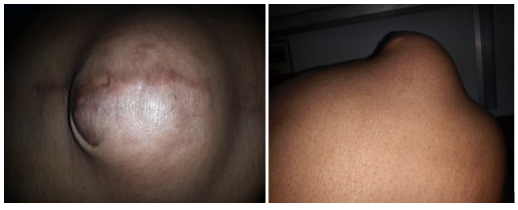

Figure-1 PREOPERATIVE PICTURE OF INCIONAL HERNIA

Figure-2 BONE MARROW ASPIRATED AND STORED IN A SPECICAN WHICH IS PRIMED WITH HEPARIN

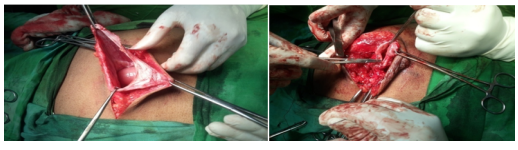

Figure-3 INTRA OPERATIVE PICTURE

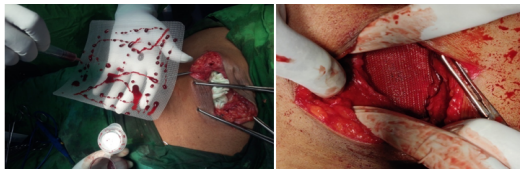

Figure-4 COATING OF MESH WITH BONEMARROW AND MESH PLACED IN PREPERITONEAL SPACE

RESULTS:

Post operatively the patients experienced less pain as compared to control group. In the study group patients did not require analgesia after post operative day 3 whereas in control group patient required analgesia up to postoperative day 7.

Table-1

Post operative day	Number of Patients required analgesia in study group	Number of Patients required analgesia in control group
1	15	15
2	12	15
3	6	15
4	0	9
5	0	5
6	0	5
7	0	2

In study group drain was removed earlier as compared to control group as seroma collection is more in control group as compared to study group. Drain was removed when there is ≤ 10 ml seroma collection in both study and control group. And in study group no patients required drain after 4th post operative day whereas in control group drain was present till 7th post operative day.

Table-2

Postoperative day	Average Seroma collection in Study group	Average seroma collection In control group
1	80	110
2	50	100
3	30	60
4	10	40
5	0	40
6	0	20
7	0	10

Out of 15 patients in control group recurrence was observed in 2 patients but in study group there was no recurrence.

Table-3

Recurrence in study group	Recurrence in control group
0/15	2/15

There is no enterocutaneous fistula and mesh migration observed in both study and control group. Patients in study group discharged earlier (post operative day 5) than control group (postoperative day 8).

DISCUSSION:

Bone marrow contains two type of stem cells: hematopoetic and stromal stem cell. Mesenchymal stem cells(MSCs) are multipotent stromal cells that can be sourced from variety of tissues, including bone marrow , adipose tissue and umbilical cord. Morphologically they resemble fibroblast. MSCs are characterized as a heterogeneous population of cells that proliferate in vitro as plastic adherent cells able to develop as fibroblast colony forming units. They express certain cell surface markers (CD105, CD73,CD90) and do not express cell surface markers associated with hematopoietic stem cells (CD34, CD45). MSCs were initially shown to have the ability to be directed to differentiate into a variety of specialized cell type of the mesodermal lineages, including osteoblast, chondrocytes, adipocytes, tenocytes and myocytes. MSCs are clearly capable of responding and modulating their function when exposed to the cells and biochemical factors that are characteristic of an injury environment. Human MSCs migrate preferentially to regions of inflammation and express several chemokine receptors that are necessary to coordinate their homing ability. Furthermore, MSCs have demonstrated chemotaxis toward a variety of wound healing cytokines in vitro, including platelet-derived growth factor, insulin-like growth factor-1, IL-8 and TNF-α. These data suggest that bone marrow derived MSCs or endogenous cells resembling MSCs, such as pericytes, are likely to migrate to and participate in the response to tissue injury.

Studies have shown that MSCs derived either from bone marrow or fat can express LEC markers (prox-1, VEGF-C, VEGF-A) and that stimulation of these cells in cultured media with recombinant VEGF-C, even for brief periods of time in vitro, markedly increased their ability to promote lymphangiogenesis in vivo. Thus adult MSCs may have an important role in decreasing seroma formation postoperatively by early healing of injured lymphatic vessels.

MSCs produce basic FGF and VEGF-A, which provide powerful mitogenic cues to promote proliferation, migration and differentiation of micro vascular endothelial cells. MSCs also express paracrine factors to promote vascular stability and vasoprotection, including adrenomedullin. It has been hypothesized that these functions are unique to MSCs due to their possible perivascular origin, and they are able to exploit these function to recreate their perivascular niche as the process of vasculature remodeling is concluded. Enhancement of vascular formation by bone marrow derived MSCs has been demonstrated in vitro and to facilitate the development of long standing functional vasculature as perivascular progenitor cells. Thus autologous bone marrow therapy may facilitate neovasularisation and thereby prevent recurrence and help in a strong repair. Regarding post operative pain, patients experienced very less pain as compared to control group may be due to anti-inflammatory activities of mesenchymal stem cells. MSCs have anti-inflammatory effects because they inhibit dendritic cells (DC) maturation and B and T cell proliferation and differentiation, that they attenuate natural killer (NK) cell killing, and that they also support suppressive T regulatory cells. MSCs also decrease the amount of IL-10 and TNF-α secreted by DC cells and increase the amount of anti-inflammatory IL-4 produced by T cells. MSCs accelerate the rate of wound closure and reepithelization and improve the quality and strength of the regenerated tissue.

In adult wound healing, inflammatory cells recruited to the wound and produce proinflammatory mediators such as monocyte chemotactic protein-1 (MCP-1), macrophage inflammatory protein-1 beta (MIP-1β), interleukin-1β (IL-1β) and IL-6. These mediators can not only induce additional inflammation but also contribute to excess extracellular matrix deposition and fibrosis. More over the inflammatory cells can produce growth factors such as transforming growth factor-beta 1(TGF-β1) and platelet derived growth factor, which stimulate fibroblast proliferation, myofibroblast differentiation, and excess ECM deposition leading to scar formation. This study is purely clinical and we have only seen the effects of autologous bone marrow therapy and the rationale behind them are still being studied at molecular level. At present our sample size is small and we will continue our research in more number of patient in future.

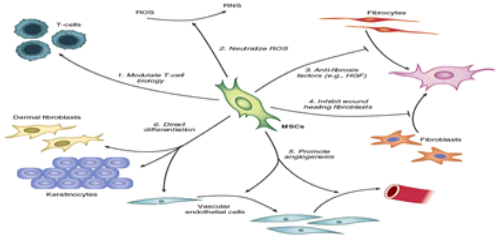

Figure-5: Mode of action of MSCs

CONCLUSSION:

Bone marrow coated mesh seemed to be a feasible technique for the repair of incional hernia with the real probability of improving prosthetic compatibility and reducing future recurrence.

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