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A CLINICAL STUDY OF THE FACTORS AFFECTING THE OUTCOME OF INTESTINAL RESECTION AND ANASTOMOSIS

Dermatology

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ABSTRACT

INTRODUCTION

Resection and anastomosis is the surgical procedure involving excision of a diseased organ with adequate margins and joining the cut ends so as to maintain anatomical continuity. Most commonly performed resection and anastomosis is that involving the intestines. The above mentioned study is a humble attempt to understand the various factors which influence the outcome of an intestinal anastomosis in order to bring forth successful anastomosis healing.

BODY

The above mentioned study has been conducted under the Department of General Surgery, Tirunelveli Medical College, with Institutional Ethical Committee approval. 50 cases of intestinal resection and anastomosis due various causes have been studied. Various factors – patient related, surgery related and post operative were analysed and compared. Patient related factors include Age, Cause for resection, Diabetes, Hypertension, biochemical parameters. Surgery related includes presence of gangrene, volume of bowel resected, type of anastomosis, and contamination of peritoneum. Post operative includes transfusion of blood and blood products, TPN. The presence or absence of these factors in the 50 patients were followed and analysed. Outcomes taken into consideration were a successful anastomotic healing, anastomotic leak and death. Factors which were found to directly influence the outcomes were cause of resection, diabetes, low serum proteins, anaemia, presence of gangrene and transfusion of blood products and TPN.

CONCLUSION

Outcome of intestinal resection and anastomosis is multi-factorial. A successful anastomosis healing is an outcome of a wholesome approach. Correction of metabolic abnormalities and supplementation of nutrients and blood products goes a long way in proper healing of the anastomotic site.

KEYWORDS

Resection and Anastomosis, Anastomotic leak

INTRODUCTION

Resection and anastomosis is the surgical procedure involving excision of a diseased organ with adequate margins and joining the cut ends so as to maintain anatomical continuity. Most commonly performed resection and anastomosis is that involving the intestines. The above mentioned study is a humble attempt to understand the various factors which influence the outcome of an intestinal anastomosis in order to bring forth successful anastomosis healing.

OBJECTIVES OF THE STUDY:

To identify the patient's clinical and surgical factors that affects the outcome of intestinal resection and anastomosis and predispose to anastomotic leak.

METHODOLOGY:

This study was conducted with the approval of institutional ethical committee. 50 cases requiring intestinal resection and anastomosis admitted in Tirunelveli Medical College were selected after applying inclusion and exclusion criteria.

These cases were followed up intra operatively and post operatively until discharge from hospital or another outcome like anastomotic leak or death of the patient.

INCLUSION CRITERIA:

1. Patients age >18yrs
2. Patients requiring intestinal resection and anastomosis

EXCLUSION CRITERIA:

1. Patient's age <18yrs
2. Pregnant women, prisoners, cognitively impaired subjects
3. Immuno compromised.

Factors studied

In this study the various factors compared and studied can be broadly classified into:

Pre operative,Intra operative,Post operative

Pre operative factors

These are non-modifiable factors. In this study the pre operative factors taken into consideration and compared are

1. Age
2. Sex
3. Co morbidities – diabetes, cardiac disease, renal disease
4. Biochemical parameters – Haemoglobin, Albumin, Renal function(Blood urea, serum Creatinine)

Intra operative factors

These are the factors that are influenced by the patient as well as the operating surgeon. These are partly non-modifiable and partly modifiable. This study evaluates how the modifiable factors influence the outcome of intestinal anastomosis

Patient related intra operative factors include

1. Etiology – Gangrene, malignancy, trauma
2. Delay in surgery – admission to incision time

Surgeon related intra operative factors include

1. Type of anastomosis based on bowel orientation

a. End to end
b. End to side
c. Side to side

2. Type of anastomosis based on bowel involved

I. Small bowel- small bowel
ii. Small bowel- large bowel
iii. Large bowel- large bowel

3. Type of anastomosis based on layers

I. Single layer
ii. Double layer

Post operative factors studied include

1. Transfusion of blood and blood products
2. TPN transfusion

PRE OPERATIVE FACTORS

AGE

Out of the 50 cases 2 cases were less than 20 years, 39 cases were between 20-60 years and 9 cases were more than 60 years. Upon comparing anastomotic leak in each age group, 33.3% of the patients undergoing anastomosis in the elderly, more than 60 years age group developed anastomotic leak as compared to the 7.7% in the 20-60 years group. None of the patients less than 20 years developed anastomotic leak.

SEX

Out of the total 50 patients including in the study, male patients numbered 38, accounting for 76% of the total study population. Women on the other hand contributed to 24% of the total number.

But upon comparing the percentage of anastomotic leak in both sexes, 100% of the patients having leak were males and none of the female patients developed anastomotic leak.

COMORBIDITIES

Presence of co morbidities play an important role in wound healing. 'Milieu interior' of human beings are altered by presence of co morbidities like diabetes mellitus, cardiac disease and renal disease.

These life style diseases tend to affect the healing property of human body. Hence the time taken for any wound to heal is profoundly increased in patients with diabetes, cardiac and renal disease.

DIABETES MELLITUS

Diabetes is an important risk factor affecting healing in patients undergoing bowel surgeries. Diabetes produces a state of decreased perfusion and inadequate angiogenesis, which in turn results in tissue hypoxia which ultimately hinders healing. The levels of Vascular Endothelium derived Growth Factors are decreased in diabetes. This also ultimately leads to inadequate angiogenesis and later poor healing. Hyperglycaemic state directly inhibits wound healing by the formation of advanced glycation end products which result in production of inflammatory cytokines like TNF-alpha and IL-1 which impair collagen synthesis. Thus the negative effect of diabetes on anastomotic healing is multi factorial.

RENAL DISEASE

Kidney injury ranges from acute kidney injury to chronic kidney disease to end stage renal disease. The common risk factors in patients with chronic and end stage renal disease which influence wound healing are poorly controlled diabetes mellitus, neuropathy, peripheral vascular disease, chronic venous insufficiency and aging. Overall, there is a wide range of uremic toxins which affect mechanisms of wound healing and functioning of multiple systems.

Overall the number of patients suffering from co morbidities was comparatively less, accounting for only 20% of the total. 40 patients or 80% were free of co morbid conditions.

Only 2 patients or 4% of the total were diabetic. Number of patients suffering from cardiac disease was 3, accounting for 6% of the total. 1 patient was suffering from kidney disease. 4 patients were known to have other co morbidities like hemi paresis.

BIOCHEMICAL PARAMETERS

The biochemical parameters included in the study are:

1. Haemoglobin
2. Serum albumin
3. Blood urea and serum Creatinine

Hb	No of cases (T=50)		Anastomotic leak	
<10	8	16%	2	25%
>10	42	84%	4	9.5%

In this study 8 out of 50 cases studied had a haemoglobin concentration less than 10g/dl. Upon following the patients postoperatively, 2 out of the 8 anaemic patients developed anastomotic, i.e. 25% of the anaemic patients developed anastomotic leak.

On comparison, out of the 42 patients with haemoglobin more than 10g/dl, 4 patients developed anastomotic leak. This amounts to only 9.5% of the 42 patients.

So presence of anaemia in patients undergoing anastomosis is a factor which adversely affects healing and predisposes to anastomotic leak.

ALBUMIN

Albumin and Anastomosis

A minimum of 3.5mg/dl of serum albumin is essential for a good healing of anastomosis.

	No. of cases (T=50)		Anastomotic leak	
<3.5	11	27.5%	4	36.3%
>=3.5	39	72.5%	2	5.1%

Out of the total 50 patients included in the study, 11 patients suffered hypo proteinemia with a serum albumin level of less than 3.5mg/dl. Post operatively, among the 11 patients with low serum albumin, 4 patients (36.3%) developed anastomotic leaked. Whereas, in patients with normal serum albumin, the percentage of patients who suffered leak was as low as 5%, i.e. only 2 patients out of 39.

This confirms the importance of serum albumin in wound healing, specifically the healing of intestinal anastomosis.

RENAL PARAMETERS

	No. of cases (T=50)		Anastomotic leak	
Elevated RFT	7	14%	4	57.14%
Normal RFT	43	86%	2	4.65%

Among the 50 patients included in the study 7 patients had elevated blood urea and serum Creatinine while 43 patients were in the normal range. Out of the 7 patients with elevated renal parameters, 4 patients developed anastomotic leak, which is about 57.14%. Whereas, among the 43 normal patients, only 2 patients developed anastomotic leak, which accounts of a very minimal 4.6%.

This clearly points towards an elevated renal function test or in other words a poor kidney function being a risk factor for anastomotic leak.

ELEVATED BLOOD SUGAR

Diabetes as mentioned above leads to a state of poor healing. An elevated blood sugar in biochemical analysis points towards the possibility of hyperglycaemia which later leads on to poor anastomotic healing.

	No. of cases (T=50)		Anastomotic leak	
Elevated RBS	13	26%	4	30.7%
Normal RBS	37	74 %	2	5.4%

13 patients, or 26% of the total 50 patients included in the study had an elevated random blood sugar. Among these 4 patients developed anastomotic leak. That is 30.7% of the patients with hyperglycaemia developed anastomotic leak. In contrast, only 2 patients or 5% of the patients with a normal random blood sugar developed anastomotic leak.

This clearly establishes the need for control of blood sugar for a successful anastomotic healing.

INTRA OPERATIVE FACTORS

For the ease of analysis, the intra operative factors studied are divided into

- Patient dependent
- Surgeon dependent

Patient Dependent Factors

These include
-Aetiology
- Delay in presentation

Aetiology

They are
- Gangrene
- Malignancy
- Others – trauma, diverticulosis etc

OTHERS

Other pathological conditions requiring intestinal resection and anastomosis include
- Multiple perforations
- Large perforations

- Mesenteric tears compromising vascularity
- Diverticulitis

	No of cases (T=50)		Anastomotic leak	
Gangrene	25	50%	5	20%
Malignancy	10	20%	0	0%
Other	15	30%	1	6.7%

50% of the patients included in the study underwent intestinal resection and anastomosis for bowel gangrene commonly as a result of obstructed hernias and other intestinal obstructions.

20% or 10 out of 50 patients underwent resection and anastomosis as a part of treatment for malignancies.30% or 15 patients underwent resection for miscellaneous conditions like multiple perforations, large perforations, mesenteric tears etc.On comparing the numbers of anastomotic leak, maximum number of anastomotic leak (5 in number) was encountered in patients who underwent resection for bowel gangrene. This number amounts to a leak rate of a huge 20% among the patients with bowel gangrene.None of the patients treated for malignancy developed anastomotic leak.A single patient treated of a miscellaneous aetiology also developed anastomotic leak.This clearly points out the high risk of developing anastomotic leak in case of patients with bowel gangrene.All safety precautions like adequate vascularity of the cut ends, adequate level of serum proteins, post operative care should be maintained for a successful outcome.

ADMISSION TO INCISION DELAY

This is more important in case of emergencies like gangrene bowel, mesenteric ischemia, traumatic bowel and mesenteric injuries etc.

The delay occurs in two fronts
- Delayed presentation of the patient
- Delay in operating

Delay in presentation of the patient

Among the total 50 patients followed, 80% or 40 patients presented with more than 1 day duration of symptoms, whereas 10 patients presented within 1 day of onset of symptoms.

Out of the total 50 patients, 6 patients developed anastomotic leak. Among these 6 patients, 4 patients presented with more than 1 day delay accounting for 66.7% of the total.
Thus it is clear that a delay in presentation influences the outcome of resection and anastomosis.

Delay in operating

Delay in operating is also more important in case of emergency cases.
1 case of small bowel volvulus which was delayed in operating developed anastomotic leak.

ANASTOMOSIS

This is the most important surgeon related factor which influence the outcome

Anastomosis can be studied under various classes.
- Based on bowel involved
- Based on orientation of bowel
- Based on number of layerBased on number of layers in which the anastomosis is done

Based on bowel involved

	No of cases (T=50)		Anastomotic leak	
SS	29	58%	1	3.44%
SL	13	26%	5	38.4%
LL	8	16%	0	0%

Out of the total 50 patients, 29 patients (58%) underwent a small bowel to small bowel anastomosis. 13 patients or 26% underwent a small to large bowel anastomosis. 9 patients underwent anastomosis between two large bowel segments.

Out of the 6 patients who developed anastomotic leak, 5 patients had undergone anastomosis between a small bowel loop and a large bowel loop, producing a leak rate of 38.4% and a single patient had undergone a small bowel to small bowel anastomosis, with leak rate of only 3.4%. Difference in type of the bowel loops and disparity in lumen size appears to have influenced the result.

While anastomosing a small bowel to a large bowel, utmost care has to be taken, especially at the anti mesenteric ends.

	No of cases (T=50)		Anastomotic leak	
End to End	37	74%	1	2.7%
End to Side	13	26%	5	38.5%

None of the cases included in the study underwent a side to side anastomosis.

74% of the patients (37 patients) underwent an end to end anastomosis, while 13 underwent end to side anastomosis. Out of the 6 patients who developed leak, 5 patients had undergone end to side anastomosis. This amounts to a leak rate of 38.5% among the patients who underwent end to side anastomosis. On the other hand only 1 patient who underwent an end to end anastomosis developed anastomotic leak, accounting for 2.7% of the total.

POST OPERATIVE FACTORS

The important post operative factors studied were transfusion of blood, blood products and TPN (Total Parentral Nutrition).

BLOOD

With respect to wound healing, the most important complication is the decrease in IL-2 levels. Interleukin-2 is an essential factor for wound healing. It is the factor which determines the tensile strength of collagen that gets deposited during wound healing. Massive blood transfusion decreases the levels of IL-2. As a result the tensile strength of the collagen that gets deposited at the anastomotic site gets reduced. This can predispose to failure of anastomosis and anastomotic leak.

On the other hand blood that is transfused provides oxygen and nutrients which are essential for wound healing. Anaemia adversely affects healing of the anastomosis by producing a state of hypoxia at the local site. Transfusion of fresh blood helps in overcoming this. Also transfusion of fresh blood provides glucose to the site of healing.

So the merits and demerits of transfusing blood for a patient undergoing intestinal resection and anastomosis has to be weighed against each other and decided upon

FRESH FROZEN PLASMA

The main uses of fresh frozen plasma are
- Correction of hypo proteinemia
- Treatment of bleeding disorders

Hypo proteinemia is one of the major risk factors for anastomotic leak. Correction of hypo proteinemia is there for critical in successful healing of anastomosis.

TOTAL PARENTERAL NUTRITION

Both blood and FFP were given to almost all patients who underwent resection and anastomosis. Whereas,TPN was transfused to only 50% of the patients.

All the patients who developed anastomotic leak had received blood transfusion and 5 out of the 6 patients had received transfusion of FFP. Commenting on whether transfusion of blood and blood products act as risk factors for anastomotic leak requires a bigger study group and a tightly controlled case and control groups. On the other hand interestingly, only 1 patient among the total 25 patients receiving TPN transfusion developed anastomotic leak as compared to 5 patients among those who did not receive TPN.Effective management of post operative nutritional status goes a long way in healing of anastomotic site and an early recovery of the patient.

OTHERS

Presence of a protective stoma – only 2 cases in the study had protective stomas made. None of them suffered anastomotic leak.

Hand sewn vs. Stapler – Since all the cases underwent anastomosis by hand sewn technique, which among the two is superior cannot be pointed out.

2 layers vs. single layer – in our institution all intestinal anastomosis

both small and large bowel are done in two layers. So commenting on this is also beyond the scope of my study

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