Original Research Article

DOI: http://dx.doi.org/10.18203/2349-2902.isj20202820

Study of negative pressure wound therapy in management of abdominal wound dehiscence

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Received: 11 April 2020 Revised: 17 June 2020 Accepted: 18 June 2020

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ABSTRACT

Background: Postlaparotomy Abdominal wound dehiscence (AWD) occurs in 0.25% to3%. Many technique are being used to manage AWD like surgical revision with open dressing/closed irrigation, temporary covering with 'Bagota bag', saline soak gause dressing, absorbable/permanent mesh. Negative-pressure wound therapy (NPWT) is a recent modality of treatment of wound. It involves controlled application of sub atmospheric pressure to local wound environment, using sealed wound dressing connected to vacuum pump. This study aimed at finding the effectiveness of negative pressure wound therapy in management of abdominal wound dehiscence over conventional methods of wound management.

Methods: This was hospital based non randomised comparative prospective interventional study carried between July 2017 to November 2019, includes all patients admitted in GMCH, Nagpur Hospital having post laparotomy AWD, excluding the patients having enter ocutaneous fistula and patient not giving consent for VAC application. Total n=60 cases were included in study. Out of 60, 30 were taken as cases in whom intervention was done by applying vaccum assisted closure (VAC) therapy and 30 were control.

Results: All 60 patients had undergone laparotomy of this patients 30 patients was applied NPWT and efficacy plotted on the parameter of, wound sepsis, wound contraction, length of hospital stay and extension of time therapy. It was found that 90% patients had negative c/s post VAC dressing, compared to 26% in post ns dressing, there was MWC of 0.86 cm in post VAC patients compared to 0.14 cm in post NS dressing, MHS was 18.9 days in cases and was 28 days in controls,13 patients had complete fascial closure in cases whereas none in controls.

Conclusions: NPWT significantly reduces the hospital stay of patients, it causes faster and higher degree of wound contraction, reduces wound sepsis thereby reducing morbidity of patients.

Keywords: Abdominal wound dehiscence, Negative pressure wound therapy, Vaccum assisted closure

INTRODUCTION

Wound dehiscence is disruption of any or all of the layers in a wound. It can be partial or complete disruption of abdominal wound closure with or without protrusion of abdominal contents. Post laparotomy wound dehiscence occurs in 0.25% to 3% of patients. 1,2 Most patient will need to return to operation theatre for resuturing. In some patients it may be appropriate to leave the wound open and treat with dressings or vacuum- assisted closure (VAC) pumps.

The use of negative pressure wound therapy (NPWT) can be dated back to the earliest civilizations. However, in these ancient times, NPWT did not involve electric vacuums because, obviously, these were not invented yet.

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Instead of vacuums, ancient men would use their mouths to create the negative pressure by sucking the wound. This sucking action continually drew fluid from the wounds and increased blood flow to the wound, much like the modern day vacuum system, although much less sanitary.

NPWT was also known as a vacuum dressing or VAC® dressing ("vacuum assisted closure"), is a therapeutic technique using a suction dressing to remove excess exudation and promote healing in acute or chronic wounds. The therapy involves the controlled application of sub-atmospheric pressure to the local wound environment, using a sealed wound dressing connected to a vacuum pump.³⁻⁶ The use of this technique in wound management increased dramatically over the 1990s and 2000s.⁷ NPWT appear to be useful in management of the open abdomen (laparotomy).⁸

General technique for NPWT is as follows: "protect the peri wound by applying a skin barrier". A dressing or filler material is fitted to the contours of a wound (which is covered with a non-adherent dressing film) and the overlying foam is then sealed with a transparent film. A drainage tube is connected to the dressing through an opening of the transparent film. A vacuum tube is connected through an opening in the film drape to a canister on the side of a vacuum pump. Vacuum source, turning an open wound into a controlled, closed wound while removing excess fluid from the wound bed to enhance circulation and remove wound fluids. This creates a moist healing environment and reduces edema. There must be an air tight seal in order for this therapy to be successful. 9,10

Abdominal wound dehiscence (AWD) has been a long term dilemma for which no surgical unit has come with a 100% plan (i.e. none of the surgical units worldwide has reported 0% failure rate). However many institutes globally have been trying successfully to achieve and keep failure rates well below 1%. These statistics however do not discourage the continuing research in attempts to eliminate the problem. A wide variety number of publications have been done in the past ten years trying to explain how this problem can be overcome. In view of increasing incidence of abdominal wound dehiscence, we have chosen to study the cases of abdominal wound dehiscence in our hospital and find the effectiveness of negative pressure wound therapy in management of abdominal wound dehiscence over other conventional methods of wound management.

METHODS

This was hospital based non randomized comparative prospective interventional study carried from July 2017 to November 2019, it includes all the patients admitted in GMCH, Nagpur Hospital having post laprotomy abdominal wound dehiscence. A total of n=60 cases were included in this study. Out of n=60, 30 were taken as

cases in whom intervention was done by applying VAC Therapy and 30 were taken as control in whom only NS dressing was done. The statistical analysis was done by open EPI software version 3.01, updated 06 April 2013 where mean and standard deviation was calculated and comparative analysis was done, p value <0.05 was considered statistically significant.

For this study approval was taken from institutional ethics committee Department of Pharmacology GMCH Nagpur and study was started only after approval.

Sample Size

Sample size was calculated according to following formula

 $S = z^2(p1q1+p2q2)/D^2$

Where,

S=sample size, P=prevalence, D=allowable error, q = 1-p, z=1.96 for 95% confidence interval

Type of intervention

The primary intervention was by NPWT delivered by any mode (for example vacuum-assisted closure (VAC® system) or simple closed-system suction drainage)or AB thera system delivered continuously or intermittently over a specified time period. The comparison was with simple Normal saline dressing.

Inclusion criteria

All cases of post laparotomy full thickness/ partial thickness abdominal wound dehiscence including all age groups.

Exclusion criteria

Patients not giving consent for applying vac and patients having Enterocutaneous fistula.

RESULTS

In this study major number of patients belonged to the age group between 51-75 years, youngest age was 2 months and oldest patient was 81 years. The mean age affected is 43.3 yrs. Abdominal wound dehiscence were more common in males 46 cases (77%) than females 14 cases (23%). Male to female ratio was 3.2:1. The type abdominal wound dehiscence was most commonly partial thickness wound dehiscence 36 case (60%) and full thickness wound dehiscence were 24 (40%). Out of 60 cases studied, 24 were of perforation peritonitis, 09 were incisional hernia, 5 were of malignancy, 4 blunt trauma abdomen, 1 psoas abscess and 3 post lower segment cesarian section (LSCS), 7 intestinal obstruction, 3 sma/smy thrombosis and other 4 cases.

The most common organism cultured from the abdominal wound dehiscence before application of VAC therapy was *stapphylococus* 30%. By the application of VAC therapy mostly no growth of organism seen in 70% of cases.

Table 1: Distribution of subjects according to age, gender and type of wound dehiscence.

Factor	No. of cases	%			
Age (in years)					
0-25	6	10			
26-50	25	41.66			
51-75	28	46.66			
76-100	1	1.66			
Gender	Frequency				
Male	46	76.66			
Female	14	23.33			
Type of wound dehiscence					
Full thickness	24	40			
Partial thickness	36	60			

Table 2: Distribution of patients with abdominal wound dehiscence according to underlying intraabdominal pathology.

Diagnosis	No. of cases
Perforation peritonitis	24
Incisional hernia	9
malignancy	5
Blunt trauma abdomen with perforation peritonitis	4
SMV/SMA Thrombosis	3
Psoas abscess	1
Post LSCS	3
Intestinal obstruction	7
Other(acute appendicitis,obstructed incisional hernia)	4
Total	60

The most common organism cultured from the abdominal wound dehiscence before normal saline dressing was stapphylococus 25%. By the normal saline dressing,

E. Coli is present in 30% and no growth of organism in 27% controls.

Thus it showed that there was significant decrease in wound sepsis of patient by application of negative pressure wound therapy. There was mean wound contraction of 0.86 cm in post VAC patients compared to 0.14 cm in post ns dressing.

The chi-square statistic is 11.28 (2-tail). The p value is 0.00078. This result was significant at p<0.05. The chi-square statistic with Yates correction is 9.611. The p value is 0.0019. Significant at p<0.05.

Table 3: Organism cultured from wound before and after application of vac.

	Frequency	%
Organisms before	•	•
Staphyloccocus	9	30
Pseudomonas	8	26.66
Klebsiella	3	10
Escherichia coli	7	23.33
No growth	3	10
Organisms after	-	•
Staphyloccocus	3	10
Pseudomonas	3	10
Klebsiella	1	3.33
Escherichia coli	2	6.66
No growth	21	70

Table 4: Post vac and post normal saline c/s cross tabulation and wound contraction.

Cross tabulation		C/s C/s positive negat		ive	Total
Vac dressing	9	9 21			30
Ns dressing	22		8	30	
Total	31		29	60	
Wound	Group	N	Mean	SD	P value
contraction	Cases	30	0.75	0.34	< 0.000
contraction '	Control	30	0.14	0.137	0001

Table 5: Hospital stay and plan at end of treatment.

	Groups	N	Mean	Standard deviation	P value	
Hospital	Cases	30	18.9	2.83	0.000009	Independent sample t test
stay	Control	30	28	6.79		
	End treatm	ent plan				P value
		Healing by secondary intension	Secondary resuturing	Tension suturing	Expired	0.03
Cuonna	Cases	11	15	4	0	
Groups	Controls	2	23	4	1	

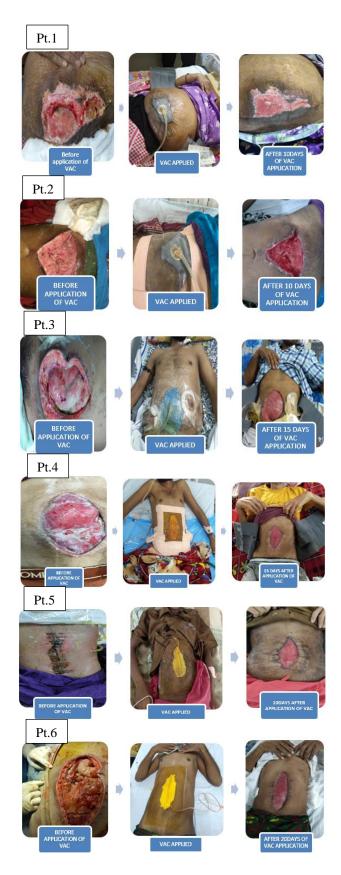


Figure 1: Pre and post negative pressure wound therapy (Pt.1-6).

(*Pt.-Patient)

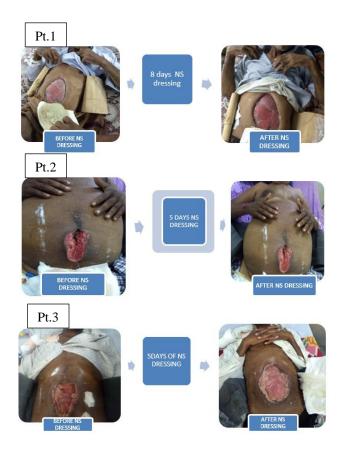


Figure 2: Pre and post normal saline dressing (Pt.1-3). (*Pt.-Patient)

Table 4 shows that there was significant decrease in wound sepsis of patient by application of negative pressure wound therapy and the above cross table also shows that there was significant wound contraction after application of VAC therapy over abdominal wound dehiscence p value is <0.0000001. Table 5 shows that there is significant decrease in hospital stay by application of VAC over abdominal wound dehiscence p value (0.000009). It also showed that patients with negative pressure wound therapy dressing has more number of healing by secondary intention and nil mortality rate.

DISCUSSION

This study addresses the superiority between two different ways of managing abdominal wound dehiscence, one is the conventional normal saline dressing and the other newer modality negative pressure wound therapy. Intraoperative and post-operative wound infection is the main cause of abdominal wound dehiscence. When the wound dehiscence occurs mostly saline dressing was done, which has to change multiple times in a day, this increased the chances of further wound infection and also distressing to patient to bear the pain during dressing. On the other hand negative pressure wound therapy increases dermal perfusion and stimulates the formation of granulation tissue, and thus, accelerates wound healing and decreases bacterial colonization

because it reduces tissue edema and interstitial tissue fluid, it also promotes wound contraction and causes facial closure. The frequency of dressing is every 2-3 weeks which has psychological benefit for patient and also prevent transmission of environmental infection from entering into wound. In literature many studies have been carried out comparing VAC therapy with Bagota bag, saline dressing, none of them has taken all the four parameter of wound c/s, wound contraction, hospital stay and mortality which will specifically show the efficacy of VAC therapy over the other conventional forms of dressing. In present study all the parameter were considered.

Table 6: Comparison of age and gender distribution in various studies.

Study		Mean age group (in years)
Subramonia et al ¹¹		60
Batacchi et al ¹²		68.3
Jang et al ¹³		61.5
Present study		46.6
	Males	Females
Subramonia et al ¹¹	33	18
Batacchi et al ¹²	50	16
Jang et al ¹³	27	23
Present study	46	16

Table 7: Comparison of organism cultured in various studies.

Study	Wound c/s positive pre- VAC	Wound c/s positive post-VAC	P value
Jang et al ¹³	55	36	0.705
Present study	27	9	0.00078

In present study abdominal wound c/s positive before application of VAC was in 27 patients out of the 30 cases and after application of VAC c/s positive reports came out in 9 patients. The p value is 0.00078 which is highly significant. In study done by Jang et al p value is not significant. In present study 26 out of 30 cases wound closure by VAC which was either healed by secondary intension or was resutured as the wound got contracted so

much that simple suturing could be possible, in 4 cases there was no wound contraction so tension suturing had to be done.¹³ In study of Subramonia et al 31 patients had successful wound closure by VAC and in study of Jang et al out of 50, 39 patients had successful wound closure.^{11,12}

Table 8: Comparison of wound closure and hospital stay in various studies.

Study	Successful wound closure by VAC	Unsuccessful wound closure by VAC
Subramonia et al ¹¹	31	20
Jang et al ¹³	39	11
Present study	26	4
	Mean hospital stay after application of VAC in days	P value
Subramonia et al ¹¹	39	
Batacchi et al ¹²	28.5	0.019
Jang et al ¹³	42	
Present study	18.9	0.000009

The hospital stay was found to be only 19 days for patients with VAC dressing, when compared to the conventional dressings, who have an average hospital stay of 28 days. Independent sample t-test showed that the study is significant (p value <0.000009). In study of Batacchi et al the mean hospital stay was 28.5 days with p value of 0.019 which is significant. ¹² In study of Jang et al and Subramonia et al mean hospital stay was 42 and 39 days respectively. ^{11,13} Patients with VAC dressing have more healing by secondary intension before discharge and nil rate of patient being expired when compared to the control group. Pearson-chi square test showed the study was significant (p value=0.030).

36.66% of cases were healed by secondary intension when compared to 0% in control group. The death rates in cases were only 0% when compared to 3.33% in control group. In study conducted by Subramonia et al out of 51 patients 27 patients wound was closed by secondary intension. In study of Jang et al mostly secondary suturing was done.

Table 9: Comparison of end of the treatment analysis in various studies.

Study	Healing by secondary intension	Secondary suturing	Split skin grafting	Tension suturing	VAC therapy stopped	Expired
Subramonia et al ¹¹	27	2	2	-	16	4
Jang et al ¹³	9	29	1	-	1	10
Present study	11	15	-	4	-	-

CONCLUSION

Negative pressure wound therapy significantly reduces the hospital stay of the patient, it causes faster and higher degree of wound contraction, it reduces the wound sepsis thereby reducing the morbidity of patients and has nil mortality rate. From above study it has been shown that negative pressure wound therapy is far more better way of managing abdominal wound dehiscence and should be used in all possible cases of abdominal wound dehiscence.

ACKNOWLEDGEMENTS

Authors would like to thank Dr. Abdul Quraishi and Dr. Sajal Mitra, for their support in the study.

Funding: No funding sources Conflict of interest: None declared

Ethical approval: The study was approved by the

Institutional Ethics Committee

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Cite this article as: Tirpude B, Borkar MM, Lokhande NN. Study of negative pressure wound therapy in management of abdominal wound dehiscence. Int Surg J 2020;7:2195-200.