MAK HILL Publications Research Journal of Medical Sciences

Research Article
doi: 10.36478/makrjms.2024.3.395.401

A Cross-Sectional Study for the Effect of Intra-Abdominal Pressure as a Factor for Abdominal Wound Dehiscence

[1]Meghraj J. Chawada, [2]Anil P. Chavan, [3]Kshitija Pokharkar, [4]Sudhir Deshmukh and [5]P.T. Jamdade

[1]Department of Surgery, VDGMC Latur, India
[2]Department of General Surgery, VDGMC Latur, India
[3]Department of Pediatric surgery, LTMC Sion Mumbai, India
[4,5]GMC Nanded, India

OPEN ACCESS

Key Words
Risk factors, intra-abdominal pressure, wound dehiscence

Corresponding Author
Anil P. Chavan,
Department of General Surgery, VDGMC Latur, India

Author Designation
[1]Associate Professor
[2,3]Junior Resident
[4]Professor and Dean
[5]Professor and HOD

Received: 20 February 2024
Accepted: 22 March 2024
Published: 4 April 2024

Citation: Meghraj J. Chawada, Anil P. Chavan, Kshitija Pokharkar, Sudhir Deshmukh and P.T. Jamdade, 2024. A Cross-Sectional Study for the Effect of Intra-Abdominal Pressure as A Factor for Abdominal Wound Dehiscence. Res. J. Med. Sci., 18: 395-401, doi: 10.36478/makrjms. 2024.3.395.401

ABSTRACT
Burst abdomen (abdominal wound dehiscence) is a serious, difficult, and frustrating postoperative complication experienced by many surgeons worldwide associated with high morbidity and mortality up to 36%, with significant effect on health care cost, for both the patients and the hospitals. To study the various risk factors for abdominal wound dehiscence. To evaluate rise in intra-abdominal pressure as a factor for abdominal wound dehiscence. The present study was a cross-sectional study for the effect of Intra-Abdominal Pressure as a factor for Abdominal Wound Dehiscence in the department of General surgery of a tertiary care hospital during a period of 18 months from January 2021 to June 2022. A written informed consent was taken from all individuals who were eligible for the study as per the inclusion criteria. The Incidence of Abdominal wound dehiscence was 13%. According to grading of intra-abdominal pressure majority 79(68.7%) were grade 1, 20(17.4%) were grade 2, 8(7%) were grade 3 and 4 each. chronic cough, Diabetes, hypertension, chest infection and wound infection were significant risk factors for Abdominal wound dehiscence. There was a statistically significant association between wound dehiscence and intraabdominal pressure. As the pressure increases the chance of wound dehiscence increases. Chronic Cough, Diabetes, Hypertension, Chest infection and wound infection and increased intraabdominal pressure was significantly associated with wound dehiscence in patients with emergency laparotomy. We need to identify the risk individuals who were at risk of developing wound dehiscence. There is a need for further studies to identify further risk factors associated with wound dehiscence.

INTRODUCTION

Burst abdomen is a serious postoperative complication that can lead to high morbidity and mortality rates, affecting both patients and hospitals[1]. Abdominal compartment syndrome (ACS) is defined as sustained intra-abdominal pressure (IAP) above 20 mmHg, which can be acute, chronic, or secondary to an acute increase in IAP upon a chronically increased IAP state. ACS is increasingly recognized in critically ill patients and contributes significantly to both morbidity and mortality[2,3].

The frequency of ACS ranges from 0.4-3.5%, but incidence may reach 10-30% in some centers, such as India. Management of ACS can range from simple dressing to further closure of the abdomen followed by intensive care. Prolonged hospital stay, repeated dehiscence, high incidence of incisional hernia and subsequent reoperation may be sequelae[5].

Several risk factors have been identified for burst abdomen, including general patient profile, preoperative medical conditions, prolonged steroid therapy, peritonitis, malignancy, intraoperative knot breakage, type and duration of surgery, prolonged postoperative abdominal distension, cough and wound infection. Wound dehiscence is related to the technique of closure of the abdomen and sutures used, with continuous running sutures ensuring tension distribution evenly along the wound length[5].

Despite advances in perioperative care and suture materials, incidence and mortality rates have not changed over the past decades due to risk factors among the patient population outweighing the benefits of technical achievements. This study aimed to assess the evaluation of intra-abdominal pressure as a factor for abdominal wound dehiscence[6,7].

Objectives:

- To study the various risk factors for abdominal wound dehiscence.
- To evaluate rise in intra-abdominal pressure as a factor for abdominal wound dehiscence.

MATERIALS AND METHODS

Study Design: A cross-sectional study.

Study Settings: Surgery department of tertiary care hospital.

Study Population: All the patients undergoing laparotomy through vertical incision with one or more risk factors like age, jaundice, uremia, diabetes, chronic obstructive pulmonary diseases, hypoalbumenimea, obesity, malignancy, emergency procedure, fecal peritonitis and steroid use were included in the study.

Study Period: 18 months.

Sample Size: With reference to study by Hegazy OT[8] Incidence of burst abdomen was 12.4%.

Formula for sample size = 4* P* Q / L2 Where P=12.4%
Q=100-12.4
=100-64.19
L=Allowable error=10% (Absolute error)
Sample size=4* 12.4* 87.6/38.44
=113.03
=Rounded to 115

Inclusion Criteria:

- All the patients undergoing laparotomy through vertical incision with one or more risk factors like age, jaundice, uremia, diabetes, chronic obstructive pulmonary diseases, hypoalbumenimea, obesity, malignancy, emergency procedure, fecal peritonitis and steroid use, Patients undergoing exploration through mini laparotomy.

Exclusion Criteria:

- Not willing to participate in the study.

After obtaining clearance from institutional ethics committee, informed consent was taken those subjects willing to participate in study. Data was collected in pretested predesigned case record form. Data was collected about sociodemographic factors like age and sex. A history of other comorbid conditions along with presenting complaints was noted. Further, these patients were subjected to a physical examination for evaluating the clinical signs. all essential investigations were carried out. Informed written consent was obtained from all participants after approval of ethical committee. All participants were subjected to emergency midline exploration. All participants of any age and of both sexes was include in the study.

Complete evaluation of all participants through history, with special consideration for age, sex, smoking, chronic drug use, especially steroids, history of previous laparotomies, medical history and history of radiotherapy and chemotherapy for malignancy all history was record in pretested predetermined proforma.

General examination was done, including evaluation of weight, height, and calculation of BMI. Preoperative investigations involved haemoglobin, serum albumin, bilirubin, aspartate aminotransferase (AST), alanine aminotransferase (ALT) and serum creatinine. General anesthesia can be appropriate for patients undergoing abdominal surgery all finding was record in proforma. Once an adequate level of anaesthesia was reach, the initial incision into the skin was make. A scalpel was first use to cut into the superficial layers of the skin with the diathermy. The incision was then continued through the subcutaneous fat, the abdominal muscles, and finally, the peritoneum[8].

For all the patients, closure of midline laparotomy wound was en- mass done with non-absorbable no. 1 (polypropylene) or slowly absorbable (PDS) (double loop) sutures in continuous single-layer fashion with 1-cm interval. The operative details were recorded with special consideration to the operative diagnosis, presence and types of adhesions, duration of surgery, the need for diversion and stoma formation, the use of intraperitoneal drain and the suture material to close the rectus sheath. During the postoperative period, visual analog scale was use for assessment of postoperative pain at 1 and 24 h, time of ambulation, time of oral feeding, hospital stay and postoperative haemoglobin was recorded in the proforma. Any postoperative complication especially chest infection, wound infection, postoperative leakage and postoperative paralytic ileus was recorded in the proforma.

Data Analysis: Data collected was entered in Excel 2019 and analysis of data were done using Statistical Package for Social Sciences for Windows, Version 22. The data on categorical variables were shown as n (% of cases) and the data on continuous variables were presented as mean and standard deviation (SD). Comparison of the distribution of categorical variables were done using the Chi-Square or Fisher's exact test. Comparison of continuous variables were done by using student T test. The value <0.05 was considered as statistically significant.

RESULTS AND DISCUSSIONS

Majority 32(27.8%) were in 41-50 and 51-60 years each, followed by 20(17.4%) were in <30 years of age, 18 (15.7%) were in 31-40 years of age and 13 (11.3%) were in >60 years of age. 67 (58.3%) were males and 48 (41.7%) were females. smoking history was present among 45 (39.2%), substance abuse was present among 6 (5.2%), chronic cough was present among 35 (30.5%) and previous laparotomy was present among 9 (7.8%). Diabetes was present among 25 (21.7%), Hypertension was present among 28 (24.3%), Connective tissue disorders was present among 12 (10.4%) and COPD was present among 16(13.9%).

Anemia was present among 25 (21.7%), abnormal serum albumin was present among 31 (27%), abnormal creatinine was present among 29 (25.2%) and abnormal Bilirubin was present among 32(27.8%), abnormal AST was present among 25(21.7%) and abnormal ALT was present among 32 (27.8%).

Majority 52 (45.2%) had peritonitis and 35(30.4%) had intestinal obstruction and 28 (24.3%) had trauma. chest infection was present among 22 (19.1%), ileus was present among 15 (13%), leakage was present among 46 (40%) and wound infection was present among 50 (43.5%).

Table 1: Frequency Distribution of Study Participants According to Sociodemographic Variables.

Variable		Frequency	Percentage (%)
Age (Years)	<30	20	17.4
	31-40	18	15.7
	41-50	32	27.8
	51-60	32	27.8
	>60	13	11.3
	<30	20	17.4
Gender	Male	67	58.3
	Female	48	41.7
BMI	Normal	74	64.3
	overweight	25	21.7
	obese	16	13.9

Table 2: Frequency Distribution of Study Participants According to Risk Factors.

Risk factors		Frequency	Percentage (%)
Smoking	Absent	70	60.8
	present	45	39.2
Substance abuse	Absent	109	94.8
	present	6	5.2
Chronic cough	Absent	90	69.5
	present	35	30.5
Previous laparotomy	Absent	106	92.2
	present	9	7.8
DM	Absent	90	78.3
	present	25	21.7
Hypertension	Absent	87	75.7
	present	28	24.3
Connective tissue disorders	Absent	103	89.6
	present	12	10.4
COPD	Absent	99	86.1
	present	16	13.9
Chest infection	Absent	93	80.9
	present	22	19.1
Ileus	Absent	100	87.0
	present	15	13.0
Leakage	Absent	69	60
	present	46	40
Wound infection	Absent	65	56.5
	present	50	43.5

Table 3: Frequency Distribution of Study Participants According to Biochemical Variables.

Biochemical variables		Frequency	Percentage
Hemoglobin	Normal	90	78.3
	Abnormal	25	21.7
Serum albumin	Normal	84	73.0
	Abnormal	31	27.0
Creatinine	Normal	86	74.8
	Abnormal	29	25.2
Bilirubin	Normal	83	72.2
	Abnormal	32	27.8
AST	Normal	90	78.3
	Abnormal	25	21.7
ALT	Normal	83	72.2
	Abnormal	32	27.8

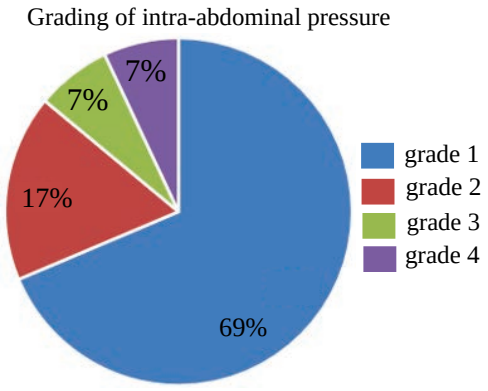

Fig. 1: Distribution of Study Participants According to Intra-Abdominal Pressure

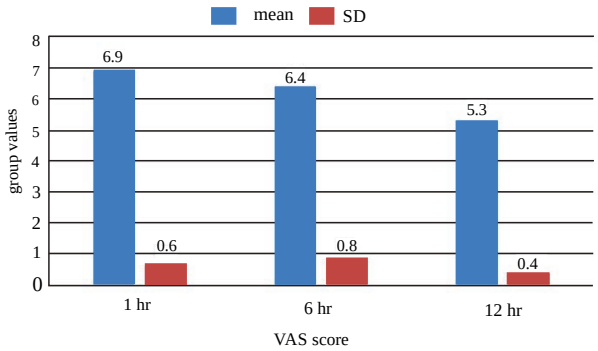

Fig. 2: Distribution of Study Participants According to VAS Score

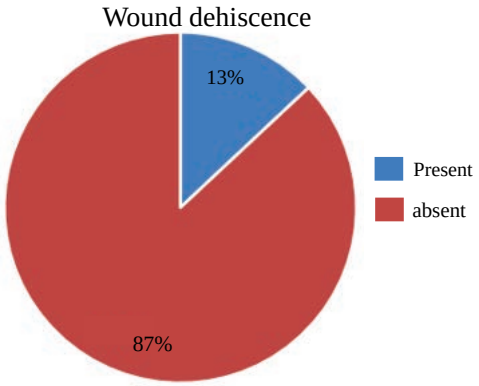

Fig. 3: Distribution of Study Participants According to Wound Dehiscence

Table 4: Association of Various Risk Factors, Intra-Abdominal Pressure with wound Dehiscence.

		wound dehiscence		
Risk factors		**absent**	**present**	**p-value**
Smoking	Absent	59(59%)	10(66.7%)	0.571
	present	41(41%)	5(33.3%)	
Substance abuse	Absent	94(94%)	15(100%)	0.330
	present	6(6%)	0	
Chronic cough	Absent	78(78%)	2(13.3%)	0.0001
	present	22(22%)	13(86.7%)	
Previous laparotomy	Absent	91(91%)	15(100%)	0.226
	present	9(9%)	0	
DM	Absent	88(88%)	2(13.3%)	0.0001
	present	12(12%)	13(86.7%)	
Hypertension	Absent	81(81%)	6(40%)	0.001
	present	19(19%)	9(60%)	
Connective tissue disorders	Absent	89(89%)	14(93.3%)	0.609
	present	11(11%)	1(6.7%)	
COPD	Absent	86(86%)	13(86.7%)	0.945
	present	14(14%)	2(13.3%)	
Chest infection	Absent	89(89%)	4(26.7%)	0.0001
	present	11(11%)	11(73.3%)	
Ileus	Absent	87(87%)	13(86.7%)	0.971
	present	13(13%)	2(13.3%)	
Leakage	Absent	54(54%)	15(100%)	0.002
	present	46(46%)	0	
Wound infection	Absent	65(65%)	0	0.0001
	present	35(35%)	15(100%)	
Intra-abdominal pressure Grading	grade 1	79(79%)	0	0.0001
	grade 2	20(20%)	0	
	grade 3	1(1%)	7(46.7%)	
	grade 4	0	8(53.3%)	

P value <0.05 is considered statistically significant

According to intra-abdominal pressure majority 79(68.7%) were grade 1, 20 (17.4%) were grade 2, 8(7%) were grade 3 and 4. Mean VAS at 1 hr was 6.98 with a SD of 0.63, mean VAS at 6 hr was 6.42 with a SD of 0.88, mean VAS at 12 hr was 5.34 with a SD of 0.47. Wound dehiscence was present among 15(13%) and absent among 100(87%). There was statistically significant association between wound dehiscence and chronic cough, Diabetes, hypertension, chest infection and wound infection. There was a statistically significant association between wound dehiscence and chest infection and intraabdominal pressure. As the pressure increases the chance of wound dehiscence increases.

The results of a study were influenced by various factors, including patient and facility factors. Factors such as demographic information, presentation and disease root cause were considered. Hospital infrastructure, staffing and workload were also crucial. The high incidence of emergency room cases may be due to the time spent managing risk factors like anemia, diabetes, malnutrition, and hypoproteinaemia. None of the elective patients showed signs of abdominal sepsis or increased intra-abdominal pressure. Emergency laparotomies are typically performed for acute abdomen cases worsening due to the progression of the illness. By the time patients are transferred to tertiary care, most have complications like septicaemia and fluid and electrolyte imbalances. In our present study, majority 32 (27.8%) were in 41-50 and 51-60 years each, followed by 20 (17.4%) were in <30 years of age, 18 (15.7%) were in 31-40 years of age and 13 (11.3%) were in >60 years of age. In a study done by Hegazy[8], 145(58%) were <40 years old and 105 (42%) were >40 years of age. In our present study, smoking history was present among 45 (39.2%), substance abuse was present among 6(5.2%), chronic cough was present among 35 (30.5%) and previous laparotomy was present among 9 (7.8%). In a study done by Hegazy[8], smoking history was present among 93 (37.2%), substance abuse was present among 38 (15.2%), chronic cough was present among 49 (19.6%) and previous laparotomy was present among 15(6%). In our present study, majority 52 (45.2%) had peritonitis and 35 (30.4%) had intestinal obstruction and 28 (24.3%) had trauma. In a study done by Hegazy[8], majority 122(48.8%) had peritonitis and 81(32.4%) had intestinal obstruction and 47 (18.8%) had trauma. Peritonitis was a significant risk factor for burst abdomen. It probably exerts its effect through sepsis-induced anemia and wound infection. Previous investigations corroborated the result. According to the findings of Jaiswal[9], peritonitis accounted for 56% of all cases. According to the findings of Ramneesh[10], perforation of the hollow viscus was seen in 70% of patients. According to Wernick[11], 72.2% of cases were classified as peritonitis. According to Parmar[12], most patients also suffered from gastrointestinal perforation (53.3 percent). According to the research carried out

by Talukdar[13], peritonitis was shown to have a substantial influence in predicting wound dehiscence. In our present study, chest infection was present among 22 (19.1%), ileus was present among 15(13%), leakage was present among 46 (40%) and wound infection was present among 50 (43.5%). In a study done by Hegazy[8], chest infection was present among 49(19.6%), ileus was present among 15(6%), leakage was present among 12(4.8%) and wound infection was present among 68(27.2%).

In our present study, wound dehiscence was present among 15 (13%) and absent among 100 (87%). In our present study incidence of burst abdomen was 13%, in a study done by Hegazy[8], incidence of burst abdomen was 12.4% in emergency laparotomy patients. Similarly in a study done by Waqar[14], incidence of wound dehiscence was 12% in emergency laparotomy patients. in a study done by Talukdar[13], incidence of wound dehiscence was 12.6% in emergency laparotomy patients. in a study done by Pamar[12], incidence of wound dehiscence was 5.6% in emergency laparotomy patients. Our study findings were consistent with previous studies.

Substance abuse and smoking were not a risk factor in a study done by Hegazy[8], Mäkelä[15] reported alcoholism as a risk factor for burst abdomen, Similar findings were found in studies sone by Choudhury[16], Afzal[17], V Ramshorst[18] and Kenig[19] also reported Substance abuse was not a risk factor, However, other authors considered Substance abuse a risk factor for abdominal wound dehiscence[20]. The presence of a persistent cough was a key element in our investigation. It is likely that its impact is caused by a rise in intraabdominal pressure in conjunction with anaemia caused by chronic element[8]. Previous research backed up the conclusions we obtained.

There was a statistically significant association between wound dehiscence and Diabetes and hypertension. In a study done by Hegazy[8], among patients without wound dehiscence, DM was present among 22 (10%), Hypertension was present among 36 (16.4%). Among patients with wound dehiscence, DM was present among 13 (41.9%), Hypertension was present among 5 (16.1%), Connective tissue disorders were present among 2(6.5%). In a study done by Mahey[21], Sucklecha[22], Zochampuia[24], found Diabetes and hypertension was a significantly associated with wound dehiscence. According to the findings of Jaiswal[9], diabetes conditions were present in 29% of the patients. According to Choudhury[16], 17.86 percent of patients diagnosed with diabetes. Diabetes was identified as a risk factor of ruptured abdomen in studies carried out by Kotwal[25] and Afzal[17]. On the other hand, Kenig[19], Ramneesh[10] and V Ramshorst[18] concluded that diabetes had no effect on the outcome.

According to Jaiswal[9], they discovered that 52.4% of patients had chest illness. Chronic obstructive pulmonary disease was identified as a risk factor of ruptured abdomen in a study carried out by Kotwal[25]. According to research by V Ramshorst[18], coughing was shown to be a risk factor in 17 percent of cases but only 4 percent of controls. Coughing was also cited as a risk factor in Kenig[19] study. According to the findings of Parmar[12] cough was present in 45% of patients. Diabetes slows the healing process for wounds in many ways. A low wound oxygenation is the consequence of inadequate perfusion and ischemia, both of which contribute to prolonged inflammation, which in turn results in the production of oxygen radicals and the subsequent damaging of tissue. The presence of a high matrix metalloprotease content leads to the breakdown of tissue. There was a statistically significant association between wound dehiscence and chest infection and wound infection.

Infection of the wound was a substantial risk factor for the bursting of the abdomen. In a study done by Hegazy[8] patients with wound dehiscence 87.7 percent got postoperative wound infections, while just 18.7 percent of those of without wound dehsicence. Each research that has been done on the subject has reaffirmed its significance: 91 percent, as stated by Muneiah[26] 73 percent, as stated by Parmar[12], 52 percent of cases as opposed to 11 percent of controls, as stated by V Ramshorst *et al*.18 61 percent of cases as opposed to 14 percent of controls, as stated by Kenig[19] and 90 percent, as stated by Ramneesh[10]. According to the findings of Talukdar[13], a wound infection is one of the risk factors for a ruptured abdomen. According to the research of Afzal[17], wound sepsis is the single most critical condition that might lead to wound dehiscence. The proliferation of bacteria results in the consumption of oxygen and the generation of toxins, both of which slow the healing process of wounds. Infection not only causes the sutures to fall out but also causes the rectus sheath to become separated. The presence of leakage in the postoperative period was a major risk factor (38.7 percent of burst abdomen cases had leakage). It was shown that leaking was a major contributing factor to the likelihood of wound infection. This indicates that it most likely produces its impact via the development of sepsis and wound infection. According to the findings of Parmar[12], 10% of patients had intestinal leakage.

There was a statistically significant association between wound dehiscence and chest infection and intraabdominal pressure. As the pressure increases the chance of wound dehiscence increases. Our study findings were similar to study done by Hegazy[8], Sukhlecha[22], G Wibisono[23], Kapoor[27], Ali[28] and Khan[20]. As the pressure increases the chance of wound dehiscence increases.

Our research is a good start toward minimizing the occurrence of burst abdomen and correcting the risk factors. Taking additional precautions when dealing with risky cases can save these patients from the high mortality rate associated with that as well as serious conditions, which is especially important in developing countries with limited resources.

CONCLUSION

The present study concludes that Chronic Cough, Diabetes, Hypertension, Chest infection and wound infection and increased intraabdominal pressure was significantly associated with wound dehiscence in patients with emergency laparotomy. We need to identify the risk individuals who were at risk of developing wound dehiscence. There is a need for further studies to identify further risk factors associated with wound dehiscence.

REFERENCES

1. Swaroop, M., M. Williams, W.R. Greene, J. Sava, K. Park and D. Wang, 2005. Multiple laparotomies are a predictor of fascial dehiscence in the setting of severe trauma. Am. Surgeon, 71: 402-405.
2. Cheatham, M.L., M.L.N.G. Malbrain, A. Kirkpatrick, M. Sugrue and M. Parr et al., 2006. Results from the international conference of experts on intra-abdominal hypertension and abdominal compartment syndrome. ii. recommendations. Intensive Care Med., 32: 1722-1732.
3. Malbrain, M.L.N.G., D. Chiumello, P. Pelosi, D. Bihari and R. Innes et al., 2005. Incidence and prognosis of intraabdominal hypertension in a mixed population of critically ill patients: A multiple-center epidemiological study. Crit. Care. Med., 33: 315-322.
4. Waqar, S.H., Z.I. Malik, A. Razzaq, M.T. Abdullah and A. Shaima,et al., 2005. Frequency and risk factors for wound dehiscence/burst abdomen in midline laparotomies. JAyub Med Coll Abbot., 17: 70-73.
5. Begum, B., R. Zaman, M.U. Ahmed and S. Ali, 2008. Burst abdomen-a preventable morbidity. My men Med J, 17: 63-66.
6. Dietz, U.A., E. ,S Debus, A. Thiede and I. Kuhfuß, 2007. Inverting bilateral figure-of-eight suture of the rectus sheath after burst abdomen with destruction of the linea alba: A new technique. J. Plast., Reco amp Aesth Surg., 60: 389-392.
7. Menke, N.B., K.R. Ward, T.M. Witten, D.G. Bonchev and R.F. Diegelmann, 2007. Impaired wound healing. Clin Dermatol., 25: 19-25.
8. Hegazy, T. and S. Soliman, 2020. Abdominal wall dehiscence in emergency midline laparotomy: Incidence and risk factors. Egypt. J. Surg., 39: 489-497.
9. Jaiswal, N.K. and S. Shekhar, 2018. Study of burst abdomen: It's causes and management. Int. Surg. J., 5: 1035-1040.
10. Garg, R., S. Sheerin, S. Surinder and S. Bir, 2014. A prospective study of predictors for post laparotomy abdominal wound dehiscence. J Clin Diagn Res, Vol. 8, No. 80 .10.7860/jcdr/2014/7348.3921.
11. Wernick, B. and S.P. Stawicki, 2018. Wound, Impaired Healing. Stat Pearls Publishing, Treasure Island, ISBN-13: 9780803619043,
12. Parmar, G., A. Gohil and V. Hathila, 2008. Burst abdomen: a grave postoperative complication. Internet J Surg., 20: 1-8.
13. Talukdar, M., S. Gopalarathnam, R. Paul and A.R. Shaan, 2016. Clinical study on factors influencing wound dehiscence in emergency exploratory laparotomy. J. Evol. Med. Dent. Sci., 5: 1934-1938.
14. Waqar, S.H., Z.I. Malik, A. Razzaq, M.T. Abdullah and A. Shaima,et al., 2005. Frequency and risk factors for wound dehiscence/burst abdomen in midline laparotomies. J Ayub Med Coll Abbo., 17: 70-73.
15. Mäkelä, J.T., H. Kiviniemi, T. Juvonen and S. Laitinen, 1995. Factors influencing wound dehiscence after midline laparotomy. Am. J. Surg., 170: 387-390.
16. Kapoor, K.K. and M.M.N. Hassan, 2017. A clinical study of abdominal wound dehiscence with emphasis on surgical management in Bangalore medical college and research institute, Karnataka, India. Int Surg J, 4: 134-140.
17. Afzal, S. and M.M. Bashir, 2010. Determinants of wound dehiscence in abdominal surgery in public sector hospital. Ann King Edward Med Univ., Vol. 14, No. 119.
18. Ramshorst, G.H.V., J. Nieuwenhuizen, W.C.J. Hop, P. Arends, J. Boom, J. Jeekel and J.F. Lange, 2010. Abdominal wound dehiscence in adults: Development and validation of a risk model. World J. Surg., 34: 20-27.
19. Kenig, J., P. Richter, A. Lasek, K. Zbierska and S. Zurawska, 2014. The efficacy of risk scores for predicting abdominal wound dehiscence: A case-controlled validation study. BMC Surg., Vol. 14, No. 65 .10.1186/1471-2482-14-65.
20. Khan, M.N., A.H. Naqvi, K. Irshad and A.R. Chaudhary, 2004. Frequency and risk factor of abdominal wound dehiscence. J Coll Phys Surg, 14: 355-357.
21. Mahey, R., S. Ghetla, J. Rajpurohit, D. Desai and S. Suryawanshi, 2016. A prospective study of risk factors for abdominal wound dehiscence. Int Surg J., 4: 24-28.

22. Sukhlecha, A.G., 2019. Prevalence of Wound Dehiscence in Patients Attending Tertiary Care Institute of Gujarat-A Cross Sectional Study. Acad. J Surg., 2: 7-9.
23. Wibisono, G. and L.F. Nembo, 2020. Abdominal Wound Dehiscence: A Review of Risk Factors, Prevention and Management in Obstetrics and Gynecology Practice. Medicinus, 8: 102-110.
24. Zochampuia, R.,et al., 2016. Clinical study of abdominal wound dehiscence in regional institute of medical sciences hospital, Manipur". Interna Jou Cur Res., 8: 25530-25537.
25. Kotwal, A., N.A. Qureshi and B.S. Sodhi, 2018. Epidemiology and predictors of wound dehiscence in abdominal surgeries. Indian J Appl Res., Vol. 7, No. 11.
26. Muneiah, N.S., N.M. Kumar, P. Sabitha and D.G. Prakash, 2015. Abdominal wound dehiscence - a look into the risk factors. IOSR J Dent Med Sci., 14: 47-54.
27. Ali, T.S., A. Kanjarawy and A. Alloush, 2020. Study of Prognostic Factors of Abdominal Wound Dehiscence After Midline Laparotomy.