

Causes of Surgical Wound Dehiscence: A Multicenter Study

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Abstract

Surgical wound dehiscence is a postoperative complication involving breakdown of surgical incision site. Despite the increased knowledge of wound healing mechanism before and after surgery, wound dehiscence may increase the length of hospital stay, increase patient inconvenience and rates of re-operation. The purpose of this study was to analyze the causes of wound dehiscence in patients undergoing reoperation at 4 hospitals of Soonchunhyang Medical Center. The number of patients in each hospital and those operated previously were compared. In addition, other characteristics of patients were compared in patients who underwent reoperation. In 22 out of 1,026 patients consulted at the Seoul hospital, 32 cases out of 1,295 at Bucheon hospital, 14 cases out of 1,687 at Cheonan hospital and 15 cases out of 374 at Gumi hospital, wound revision was performed for wound dehiscence. Patients at the Department of Obstetrics and Gynecology were the most common and included 33 patients (39.8%). The most common intervention before wound revision was Cesarean section in 14 patients (19.3%). In this study, we retrospectively reviewed patients who underwent wound revision due to wound dehiscence and analyzed the underlying causes of the postoperative complication.

Keywords: Surgical wound dehiscence, Postoperative complications, Reoperation

Introduction

Surgical wound dehiscence is a postoperative complication involving breakdown of surgical incision site. Despite the increased knowledge of wound healing process before and after surgery and the development of preoperative care and suture materials, wound dehiscence may increase the length of hospital stay, increase patient inconvenience and rates of re-operation. In addition, wound dehiscence after abdominal surgery is associated with mortality rates of 10–44% [1,2].

Several studies investigated risk factors causing wound dehiscence. Patients older than 65 years are more likely to develop wound dehiscence because of deterioration in tissue repair mechanism compared with younger patients [3]. Other well-known risk factors include hypoproteinemia, local wound infection, anemia, hypertension, and emergency surgery [1]. Risk factors that increase intra-abdominal pressure such as abdominal distension, excessive coughing, vomiting, and constipation increase the possibility of wound dehiscence after surgery [4]. In addition, surgical experience, operative time exceeding 2.5 hours, type of incision, suture material, drain, medical history such as obesity with body mass index (BMI) greater than 30 [5], stroke, chronic obstructive pulmonary disease (COPD), pneumonia, and malignancy also affect wound dehiscence [6]. In particular, studies show increased wound dehiscence rates in patients with more than 5 risk factors [1].

Despite many studies investigating the risk factors causing wound dehiscence and efforts to control them, patients continue to suffer from wound dehiscence. The pur-



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Table 1. Comparison of patients referred to Department of Plastic and Reconstructive Surgery and patients who underwent wound revision for wound dehiscence at four hospitals of Soonchunhyang Medical Center

Hospital	Wound dehiscence	
Gumi	15/374	4.01%
Cheonan	14/1687	0.8%
Bucheon	32/1295	2.47%
Seoul	22/1026	2.14%

pose of this study is to analyze the causes of wound dehiscence in patients undergoing reoperation at 4 hospitals of Soonchunhyang Medical Center, South Korea.

Methods

From January 2013 to November 2017, patients underwent surgery at other departments and reoperation following a diagnosis of wound dehiscence and referral to the Department

Table 2. Characteristics of patients who underwent wound revision at Department of Plastic and Reconstructive Surgery at four hospitals of Soonchunhyang Medical Center

Patient	Sex	Age	Department	Cause	BMI	DM Hx.	HTN Hx.	Smoking status	Period to reoperation
1	Female	20	OBGY	C/Sec	27.60	no	no	no	18 days
2	Female	53	OBGY	Uterine myomectomy	26.01	no	yes	no	25 days
3	Female	24	OBGY	C/Sec	23.05	no	no	no	38 days
4	Male	77	UR	Circumcision	23.44	no	no	no	17 days
5	Female	61	EM	Primary repair	23.75	no	no	20 PYs	20 days
6	Male	38	NS	Decompressive craniectomy	23.41	no	no	no	21 days
7	Male	72	OS	Laminectomy	19.53	no	no	25 PYs	16 days
8	Female	33	OBGY	C/Sec	28.55	no	no	no	13 days
9	Male	26	TS	Pneumothorax	21.38	no	no	4 PYs	12 days
10	Female	27	OBGY	Ectopic pregnancy	20.68	no	no	no	9 days
11	Female	31	OBGY	C/Sec	19.92	no	no	no	28 days
12	Female	77	EM	Primary repair	24.17	no	no	no	12 days
13	Female	35	OBGY	C/Sec	19.75	no	no	no	6 days
14	Female	34	OBGY	C/Sec	26.25	no	no	no	16 days
15	Female	39	OBGY	C/Sec	29.20	no	no	no	9 days
16	Female	49	OBGY	Total hysterectomy	25.39	no	no	no	20 days
17	Female	59	OBGY	Salpingo-oophrectomy	35.52	yes	yes	no	30 days
18	Female	44	OBGY	Total hysterectomy	20.23	no	no	no	21 days
19	Female	35	OBGY	Laparoscopic salpingo-oophrectomy	24.24	no	no	no	15 days
20	Female	40	OBGY	C/Sec	21.18	no	no	no	25 days
21	Female	40	OBGY	Total hysterectomy	34.04	no	no	no	35 days
22	Male	44	NS	Primary repair	22.99	no	no	20 PYs	17 days
23	Male	23	EM	Primary repair	17.90	no	no	3 PYs	11 days
24	Female	54	GS	Panperitonitis	28.89	no	no	no	29 days
25	Female	81	NS	Laminoplasty	29.00	no	yes	no	13 days
26	Female	75	OBGY	Salpingo-oophrectomy	18.65	no	no	no	48 days
27	Female	36	OBGY	C/Sec	27.84	no	yes	no	19 days
28	Female	83	OBGY	Vulvectomy	20.69	no	yes	no	7 days
29	Female	17	OS	Primary repair	23.34	no	no	no	21 days
30	Female	40	OBGY	C/Sec	23.71	no	no	no	15 days
31	Male	31	OS	Mass excision	24.22	no	no	5 PYs	20 days
32	Female	49	OBGY	Total hysterectomy	45.26	yes	yes	no	21 days
33	Female	37	OBGY	C/Sec	26.35	no	no	no	34 days
34	Male	16	OS	Primary repair	23.62	no	no	no	29 days
35	Female	58	OBGY	Total hysterectomy	23.26	no	no	no	22 days
36	Female	70	IM	ICD insertion	20.70	no	yes	no	48 days

(Continued to the next page)

Table 2. Continued

Patient	Sex	Age	Department	Cause	BMI	DM Hx.	HTN Hx.	Smoking status	Period to reoperation
37	Female	32	OBGY	C/Sec	20.80	no	no	no	20 days
38	Female	38	OBGY	Uterine myomectomy	18.59	no	no	no	143 days
39	Female	59	OBGY	Total hysterectomy	36.30	yes	no	no	29 days
40	Female	74	EM	Primary repair	27.47	yes	yes	no	19 days
41	Male	74	IM	ICD insertion	28.51	no	no	no	13 days
42	Male	31	NS	Primary repair	32.51	no	no	no	6 days
43	Male	23	EM	Primary repair	21.61	no	no	no	6 days
44	Female	69	OBGY	Total hysterectomy	26.05	no	yes	no	57 days
45	Female	19	OBGY	Salpingo-oophrectomy	24.13	no	no	no	53 days
46	Male	26	NS	Lumbosacral fusion	19.88	no	no	no	36 days
47	Male	42	NS	Craniotomy	23.57	yes	no	20 PYs	28 days
48	Female	73	GS	Panperitonitis	37.06	no	yes	no	75 days
49	Female	41	GS	Mastectomy	19.13	no	no	no	38 days
50	Female	52	OBGY	Primary repair	25.75	no	no	no	15 days
51	Female	44	NS	Decompressive craniectomy	22.24	no	no	no	13 days
52	Female	75	OS	Achilles tendon repair	25.07	no	yes	no	45 days
53	Female	31	OBGY	C/Sec	28.00	no	no	no	52 days
54	Male	57	OS	Mass excision	26.30	no	no	no	133 days
55	Female	51	GS	Low anterior resection	30.86	no	yes	10 PYs	35 days
56	Female	47	GS	Loop ileostomy	18.23	no	no	5 PYs	54 days
57	Female	0	NS	Skull fracture	-	no	no	no	9 days
58	Male	6	OS	Polysyndactyly	15.97	no	no	no	22 days
59	Female	51	OBGY	Total hysterectomy	28.20	yes	yes	no	36 days
60	Male	55	GS	Abdominal perineal resection	22.43	no	no	35 PYs	85 days
61	Female	57	OS	Primary repair	19.72	yes	yes	no	28 days
62	Female	53	OBGY	Total hysterectomy	27.53	no	no	no	17 days
63	Female	73	NS	Cranioplasty	18.67	no	yes	no	26 days
64	Male	38	OS	Mass excision	24.63	yes	no	no	27 days
65	Male	48	EM	Primary repair	25.86	no	no	no	7 days
66	Female	61	NS	Laminectomy	22.09	no	yes	no	179 days
67	Female	34	OBGY	C/Sec	24.03	no	no	no	47 days
68	Male	32	ENT	Primary repair	23.67	no	no	no	5 days
69	Female	66	TS	Mitral valve replacement	22.60	no	no	no	45 days
70	Male	54	NS	Decompressive craniectomy	27.33	no	no	9 PYs	32 days
71	Female	49	NS	Decompressive craniectomy	20.89	no	no	no	23 days
72	Female	74	OBGY	Total hysterectomy	30.75	yes	no	no	31 days
73	Male	34	EM	Primary repair	18.84	no	no	no	6 days
74	Male	89	GS	Panperitonitis	20.48	no	no	no	25 days
75	Female	47	EM	Primary repair	21.34	no	no	no	14 days
76	Male	73	GS	Loop colostomy	23.97	yes	no	20 PYs	30 days
77	Female	67	OS	Primary repair	23.61	no	no	no	19 days
78	Male	49	NS	Craniotomy	24.50	no	no	14 PYs	21 days
79	Male	63	GS	Pancreaticoduodenectomy	22.89	no	yes	no	19 days
80	Male	49	OS	Trimalleolar fracture	20.31	no	no	10 PYs	143 days
81	Male	82	GS	Permcath insertion	19.75	no	yes	30 PYs	14 days
82	Female	78	NS	Craniotomy	25.97	no	yes	no	8 days
83	Female	45	NS	Meningioma	21.31	no	no	no	10 days

PY, Pack-year.

of Plastic and Reconstructive Surgery at 4 hospitals of Soonchunhyang Medical Center. The patients were divided into two groups: conservative treatment and surgical treatment. The number of patients in each hospital and previous operation were compared. In addition, age, time from previous surgery to postoperative reoperation, and other medical histories were compared in patients who underwent reoperation.

Results

Twenty-two out of 1,026 patients consulted at Seoul hospital, 32 cases out of 1,295 at Bucheon hospital, 14 cases out of 1,687 at Cheonan hospital and 15 cases out of 374 in Gumi hospital, underwent wound revision for wound dehiscence (Table 1). The patients were classified according to age, previous diagnosis or operation, duration of revision after first operation, and past medical history (Table 2). The patients included 27 males (32.5%) and 56 females (67.5%) with an average age of 48.35 years (0-89 years). Obstetrics and Gynecology (OBGY) was the most common department with 33 patients (39.8%) followed by 15 patients from Neurosurgery (NS), 11 patients from Orthopedic Surgery (OS), 10 patients from General surgery (GS), 8 patients from Emergency Medicine (EM), 2 patients from Thoracic Surgery (TS), 2 patients from Internal medicine (IM), 1 patient from Urology (UR), and 1 patient from Otolaryngology (ENT) departments. The most common surgical history was primary repair by various departments (16 patients, 19.3%). The second common surgical history was Cesarean section (C/Sec) in 14 patients (16.9%), which accounted for 42.4% of all patients who underwent wound revision after operation at OBGY. The mean BMI of the patients was 24.4 (Range of 15.97–45.26). The mean BMI of the patients of OBGY was 25.98 (Range of 18.59–45.26), and patients who underwent C/Sec was 24.73 (Range of 19.75–29.2). Nineteen patients (22.9%) had a history of hypertension (HTN) and 10 patients (12.0%) had diabetes (DM). The current or ex-smokers included 15 patients (18.1%) and the average pack-year (PY) was 15.3 PYs (Table 3). The mean time from the first operation to wound revision was 30.8 days. It was 24.29 days for patients from OBGY and 25.98 days for patients undergoing C/Sec was.

Discussion

Various causes of wound dehiscence include surgical experience, surgical incision, suture material, and patient factors

Table 3. Analysis of patients who underwent wound revision at Department of Plastic and Reconstructive Surgery at four hospitals of Soonchunhyang Medical Center

		Number	Rate (%)	Mean	
Sex	Female	56	67.5	-	
	Male	27	32.5	-	
Age (year-old)		-	-	48.35	
BMI (kg/m ²)		-	-	24.43	
Department	OBGY	33	39.8	-	
	GS	10	12.0	-	
	OS	11	13.3	-	
	UR	1	1.2	-	
	EM	8	9.6	-	
	TS	2	2.4	-	
	NS	15	18.1	-	
	IM	2	2.4	-	
	ENT	1	1.2	-	
History	DM	10	12.0	-	
	HTN	19	22.9	-	
	Smoking (Current or ex-smoker)	15	18.1	15.3 PYs	
Cause	-	Primary repair	16	19.3	-
	OBGY	C/Sec	14	14.5	-
		Total hysterectomy	10	12.0	-
		Salpingo-oophorectomy	3	3.6	-
		Uterine myomectomy	2	2.4	-
		Vulvectomy	1	1.2	-
		Laparoscopic salpingo-oophorectomy	1	1.2	-
		Ectopic pregnancy	1	1.2	-
	UR	Circumcision	1	1.2	-
	OS	Achilles tendon repair	1	1.2	-
		Mass excision	3	3.6	-
		Trimalleolar fracture	1	1.2	-
	NS	Polysyndactyly	1	1.2	-
		Skull fracture	1	1.2	-
		Meningioma	1	1.2	-
		Lumbosacral fusion	1	1.2	-
		Laminoplasty	1	1.2	-
		Laminectomy	2	2.4	-
		Decompressive craniectomy	4	4.8	-
	TS	Craniotomy	3	3.6	-
		Cranioplasty	1	1.2	-
		Mitral valve replacement	1	1.2	-
	IM	Pneumothorax	1	1.2	-
		ICD insertion	2	2.4	-
	GS	Permcath insertion	1	1.2	-
		Panperitonitis	3	3.6	-
		Pancreaticoduodenectomy	1	1.2	-
Abdominal perineal resection		1	1.2	-	
Low anterior resection		1	1.2	-	
Loop ileostomy		1	1.2	-	
Loop colostomy		1	1.2	-	
Mastectomy		1	1.2	-	

such as age, nutritional status, and other accompanying diseases [1,4-6]. Preoperative risk factors include poor laboratory findings, infection, hypertension, and emergency surgery [1]. In particular, wound infection is the most relevant factor [6], and it increases the possibility of wound dehiscence by decreasing tensile strength and fibroblast concentration. Decreased fibroblast concentration triggers tissue destruction during wound healing [1]. Hypoproteinemia also reduces tensile strength [6]. It is required to reduce the incidence of wound dehiscence through preoperative control of these areas. Postoperative risk factors include abdominal distension, excessive coughing, vomiting, and constipation [5], and resolving these symptoms with appropriate medication may reduce the likelihood of wound dehiscence.

In this study, we retrospectively reviewed patients who underwent wound revision due to wound dehiscence with reference to various causes. We reviewed the operative and other medical history prior to wound revision and analyzed the causes of wound dehiscence.

First of all, proportion of female patients were higher than male patients, but this result may be less meaningful in that proportion of patients with wound dehiscence was higher in OBGY patients. The most common surgical history was primary repair, but this also has less significance in that this data includes primary repair in the emergency room by residents. Unlike previous literature, age, BMI, medical or social history did not show any special significance in this study. However, The results suggest that the proportion of patients with wound dehiscence requiring wound revision was higher in patients who underwent operation by OBGY department, especially after C/Sec. This high rate of wound dehiscence after C/Sec or other OBGY surgery at multiple center of this study suggest that there may be some relation between wound dehiscence and OBGY surgery, especially C/Sec.

C/Sec is still one of the most commonly used surgical techniques in obstetrics and gynecology. Currently, 36% of deliveries in Korea are performed by C/Sec [7]. In the United States, about one-third of all mothers undergo C/Sec, and 15% of all deliveries worldwide are performed by C/Sec [8]. Despite the generalization of C/sec, marital morbidity and mortality risk are still higher than vaginal delivery [5,8]. Wound dehiscence and infection after C/Sec are important causes of postoperative morbidity and account for 10% of pregnancy-related mortality [10]. The rate of postoperative wound dehiscence after C/Sec has been reported to be 2.5–16% [11]. In this study, 16.9% of patients who underwent wound revision were C/Sec

patients despite the usual method, which shows that our results are similar to those of previous literature. On the other hand, the rate of wound dehiscence after other abdominal surgery has been reported to be 0.4–3.5% [2,3,6]. However, there are few studies comparing C/Sec or OBGY surgery with other abdominal surgery.

In addition, previous studies have shown that wound dehiscence usually occurs 4 to 14 days after surgery and occurs most commonly between 6 and 8 days. Wound dehiscence may occur even after 30 days post-surgery [2,4]. In this study, wound revision was performed at an average of 30.8 days after the first operation. However, one limitation of our data is that the actual onset time of wound dehiscence was not verified; there probably will be some difference between the onset of dehiscence and the time of re-operation.

The limitations of this study are as follows: First, the number of patients is limited, and the effect of other factors may not be considered as a retrospective study. Second, when selecting the patient group, the patient's diagnosis was retrospectively confirmed. Therefore, it is possible that these patients may have been excluded in the absence of a diagnosis of wound dehiscence although wound revision was performed. Third, because of the selection of patients who underwent wound revision among patients with wound dehiscence, the boundary between surgery and conservative treatment was based on subjective aspects. Fourth, other aspects of the patient group were not considered. For example, severe abdominal distension results in a higher incidence of wound dehiscence [1]. However, the factors for evaluation of maternal abdominal distension were not reflected in the patients who underwent C/Sec.

This study showed a difference in wound dehiscence based on the type of surgery. A randomized controlled study with large number of patients undergoing different surgeries and collaborative research among multiple departments is needed. Such a study will facilitate identification of modifiable risk factors for surgery with a high probability of wound dehiscence and focus attention on the control of risk factors contributing to wound dehiscence.

Conclusion

This study analyzed the incidence of surgical wound dehiscence by investigating the causative factors and the differences among patient groups across several medical centers. Therefore, it is essential to consider the risk factors causing wound

dehiscence in advance for preventive interventions. In addition, further studies with a well-controlled and cooperative design are required to address the study limitations.

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References

1. Cöl C, Soran A, Cöl M. Can postoperative abdominal wound dehiscence be predicted? *Tokai J Exp Clin Med* 1998;23:123-7.
2. Amini AQ, Khan NA, Ahmad J, et al. Management of abdominal wound dehiscence: still a challenge. *Pak J Surg* 2013;29:84-7.
3. Van Ramshorst GH, Nieuwenuizen J, Hop WC, et al. Abdominal wound dehiscence in adults: development and validation of a risk model. *World J Surg* 2010;34:20-7.
4. Sandy-Hodgetts K, Ousey K, Howse E. Top ten tips: management of surgical wound dehiscence. *Wounds International* 2017;8:11-5.
5. Newlin C, Kuehl TJ, Pickrel A, et al. Cesarean section incision complications and associated risk factors a quality assurance project. *Open J Obstet Gynecol* 2015;5:789-94.
6. Shanmugam VK, Fernandez S, Evans KK, et al. Postoperative wound dehiscence: predictors and associations. *Wound Repair Regen* 2015;23:184-90.
7. Chung SH, Seol HJ, Choi YS, et al. Changes in the cesarean section rate in Korea (1982-2012) and a review of the associated factors. *J Korean Med Sci* 2014;29:1341-52.
8. Figueroa D, Jauk VC, Szychowski JM, et al. Surgical staples compared with subcuticular suture for skin closure after cesarean delivery: a randomized controlled trial. *Obstet Gynecol* 2013;121:33-8.
9. Basha SL, Rochon ML, Rust OA, et al. Randomized controlled trial of wound complication rates of subcuticular suture vs staples for skin closure at cesarean delivery. *Am J Obstet Gynecol* 2010;203:285. e1-8.
10. Diebold KE. Risk factors for wound complications following cesarean delivery. MS (Master of Science) thesis, University of Iowa, 2014.
11. Chelmow D, Rodriguez EJ, Sabatini MM. Suture closure of subcutaneous fat and wound disruption after caesarean section: a meta-analysis. *Obstet Gynecol* 2004;103:974-80.