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LETTER TO EDITOR

Abdominal drainage may be a risk factor for surgical site infection following appendectomy

KEYWORDS
Abdominal drainage;
Appendicitis;
Intraoperative culture;
Risk factors;
Surgical site infection

Dear Editor,

We recently read the article "Can laparoscopic appendectomy be safely performed by surgical residents without prior experience of open appendectomy?" by Hiramatsu et al in your journal.[1] They demonstrated comparable surgical outcomes, including surgical site infection (SSI), after laparoscopic appendectomy between operators with different surgical experience. We agree with their opinion because it is realistic and can contribute to educating young surgeons in laparoscopic surgery. Abdominal drainage was performed in cases of complicated or perforated appendicitis in their study, but the impact of abdominal drainage on SSI was not well described.

We performed a Japanese multicenter study to identify the risk factors for post-open appendectomy SSI, focusing on abdominal drainage, because abdominal drains have been traditionally used for complicated or perforated appendicitis in Japan (Appendix supplementary data). A total of 1701 patients were eligible for our study. SSI occurred in 143 (8.4%) patients, including 90 patients with incisional SSI and 61 with organ/space SSI. On univariate analysis, advanced age, longer operative time, blood loss, extended incision, subcutanous and abdominal drainage, and gangrenous inflammation were significant risk factors for SSI (Table 1). Multivariate analysis showed that abdominal drainage ($P < 0.001$), blood loss ($P = 0.044$), extended incision ($P = 0.029$), and gangrenous inflammation ($P = 0.007$) were independent risk factors for SSI. Abdominal drainage was also an independent risk factor for both incisional and organ/space SSIs (Appendix supplementary data). More importantly, abdominal drainage was found to be the strongest independent risk factor, regardless of inflammatory grade (Appendix supplementary data).

SSI is the most frequent complication after open appendectomy. The incidence of SSI needs to be reduced because it adversely affects length of hospitalization, pain, and costs. Petrowsky et al, in a systematic review, demonstrated that intra-abdominal drains in perforated or gangrenous appendicitis did not reduce the incidence of SSI.[2] Similarly, a recent systematic review analyzing six prospective trials involving patients with complicated appendicitis showed that postoperative complications increased significantly in the abdominal drainage group (risk ratio: 6.67), but the frequency of intra-abdominal abscess was not significantly differed.[3] Moreover, in a study of perforated appendicitis in children, an abdominal drainage group analyzed retrospectively and a no drainage group analyzed prospectively were compared. Both incisional and intra-abdominal abscesses were found to be significantly decreased in the no drainage group.[4] These reports concluded that prophylactic abdominal drainage is unnecessary even for the treatment of severe appendicitis. Possible reasons why abdominal drainage does not reduce SSI

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Table 1 Univariate and multivariate logistic regression analyses to identify risk factors for SSI (n = 1701).

	Univariate			Multivariate		
	OR	95% CI	*P*	OR	95% CI	*P*
Age (>75 y)	2.78	1.65–4.68	**<0.001**			
Sex (Male)	1.35	0.95–1.92	**0.10**			
Operative time (>60 min)	4.25	2.84–6.35	**<0.001**			
Blood loss (>100 ml)	4.63	3.05–7.03	**<0.001**	1.59	1.01–2.48	**0.04**
Type of incision (Extended)	4.64	3.20–6.74	**<0.001**	1.62	1.05–2.49	**0.03**
Subcutaneous drainage (Yes)	2.41	1.23–4.74	**0.01**			
Abdominal drainage (Yes)	10.12	6.40–16.00	**<0.001**	5.24	3.05–9.02	**<0.001**
Inflammatory grade (Gangrenous)	5.12	3.36–7.78	**<0.001**	1.92	1.20–3.09	**0.007**

The bold number indicates P < 0.05.

were as follows: drain occlusion due to blood or coagulation; insufficient drainage of the abdominal cavity; and intra-abdominal abscess occurrence even after drainage.[3]

With regard to laparoscopic appendectomy, similar results were reported: abdominal drainage after laparoscopic appendectomy for perforated appendicitis did not prevent SSI and was associated with longer hospital stay, suggesting no need for abdominal drainage.[5] Therefore, the indication for abdominal drainage after both open and laparoscopic appendectomy needs to be reconsidered.

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Declarations of interest

None.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.asjsur.2019.05.007.

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