Peer reviewed article

No benefit from post-caesarean wound drainage

A prospective randomised controlled trial

Nadin Ochsenbein-Imhof, Albert Huch, Renate Huch, Roland Zimmermann

Department Obstetrics and Gynaecology, University Hospital, Zurich, Switzerland

Summary

Aim of the study: A prospective randomized controlled trial to determine the benefit of caesarean wound drainage in 305 low-risk pregnant women.

Methods: Pregnant women at low risk of haemorrhage undergoing caesarean section in the Department of Obstetrics,University Hospital, Zurich, between June 1998 and July 1999 were randomised after informed consent into a no-suction group (n = 154) without post-caesarean wound drainage versus a control group with wound drainage (subfascial and subcutaneous) (n = 151).

Outcome measures were perioperative decrease in haemoglobin (Hb), postpartum fever (>38.5 °C for >2 days), sonographic haematoma and other complications requiring revision, cumulative opiate dose adjusted to body weight, length of hospitalisation and operation time.

Results: 305 patients completed the study. Decrease in Hb and the rates of fever, haematoma and revision were similar in both groups. However, cumulative opiate dose was lower in the no-suction group (4.5 ± 1.8 *vs* 2.8 ± 1.4 injections, p = 0.0001), and hospital stay was shorter (6.5 ± 2.4 *vs* 7.4 ± 2.8 days, p = 0.0058), as was operation time (32.7 ± 11.3 *v* 36.1 ± 10.5 min; p = 0.0071).

Conclusions: Routine post-caesarean wound drainage is not only useless but cost-ineffective. In the light of our results, wound drainage may be questioned and should be analysed generally.

Keywords: wound drainage; caesarean section

Introduction

Drainage systems have been routinely used since the early modern surgical era [1], on the grounds that body fluids and necrotic material offer an optimal growth medium for microorganisms [2]. They are also thought to decrease postoperative pain and wound infection. Suction is the preferred modality: a 1988 study showed that a suction tube placed beneath the rectos sheath was significantly superior to subcutaneous corrugated drainage in preventing post-caesarean wound infection [3]. Thus, in the Department of Obstetrics, Zurich University Hospital and in other European centres, twin subfascial and subcutaneous suction tube insertion has until recently been systematic after caesarean section. In contrast, in other obstetric centres, especially in the UK, in Australia and in the USA, suction tubes are not in routine use.

The weight of experimental evidence in favour of the practice is less impressive than that of tradition. Suction drains the wound of fluid and therefore could promote capillary haemostasis and progressive wound healing by optimal tissue contact [4]. Reservations prompted by drainage include the fact that it also prolongs operation time and increases costs, while itself constituting a source of infection [5]. Specific complications include accidental suturing of the tube or haemorrhage from a neighbouring blood vessel on removal. More importantly, modern surgery uses routine potent antibiotic prophylaxis [6] and improved skin disinfection. Operation times for caesarean section have also shortened markedly. In the absence of specific studies performed in this transformed surgical environment, we decided to test the efficacy of wound drainage after caesarean section in a prospective randomised trial under standardised modern operating conditions.

Methods

Patients and randomisation

Women undergoing elective and intrapartum caesarean sections at the University Hospital of Zurich from June 1998 to June 1999 were eligible (figure 1). Of the total of 411 women, 106 were not randomised due to refusal of consent (n = 48), increased bleeding risk [HELLP syndrome (haemolysis, elevated liver enzymes and low platelets), pre-eclampsia, bleeding diathesis (von Willebrand), thrombocytopenia or anticoagulation] (n = 32), emergency caesarean section (n = 22), and severe foetal deformity (n = 4). Informed consent was obtained from all other patients (n = 305) and the study design was approved by the hospital ethics committee.

Randomisation was done by an opaque sealed envelope (sealed by the author) opened at the beginning of the operation in the operating theatre by the nurse stating *drainage: yes* or *drainage: no*. Haemostasis was surgically secured in all cases before closing the abdomen, ensuring that a concern for haemostasis did not override the randomisation instruction. Most operations were performed by registrar-grade staff. Operative technique and suture materials were standardised for the duration of the trial. Operative time was recorded as a standard in all cases by the anaesthetists. All patients received perioperative antibiotic prophylaxis (ceftriaxone 1 g i.v.). Data was collected and allocation schedule controlled by the author.

Endpoints

Primary endpoints: decrease in haemoglobin (Hb) concentration (preoperative-postoperative Hb); fever (>38.5 °C for >2 days); and opiate use (number of injections of nicomorphine 0.1 mg/kg body weight). Minor endpoints were 3-dimensional sonographic haematoma [calculated using the formula $\pi/6\ (a \times b \times c)$], other complications requiring revision (abscess and complications of drain insertion, e.g. accidental suture fixation causing bleeding and tearing during removal), length of hospitalization, and duration of operation (from skin incision to closure). Suction flasks were removed 16 hours postoperatively and fluid volumes were measured thereafter.

Statistics

Sample size calculation showed that 40 patients per group were required to detect a 1mg/dL difference in pre- vs postoperative Hb with 95% power at the 5% significance level. The same number sufficed for a doubling in febrile days from 2 to 4 to be statistically significant. Because minor endpoints were potentially rare, 150 participants per group were considered necessary for significant results in major and minor endpoints. Stata 6, software was used for all analyses. To test whether the distribution of continuous variables deviates from a normal distribution, we used Shapiro Francia W. Variables were compared by using Student's t test and Mann Whitney U test.

All results are shown as mean ± standard deviation.

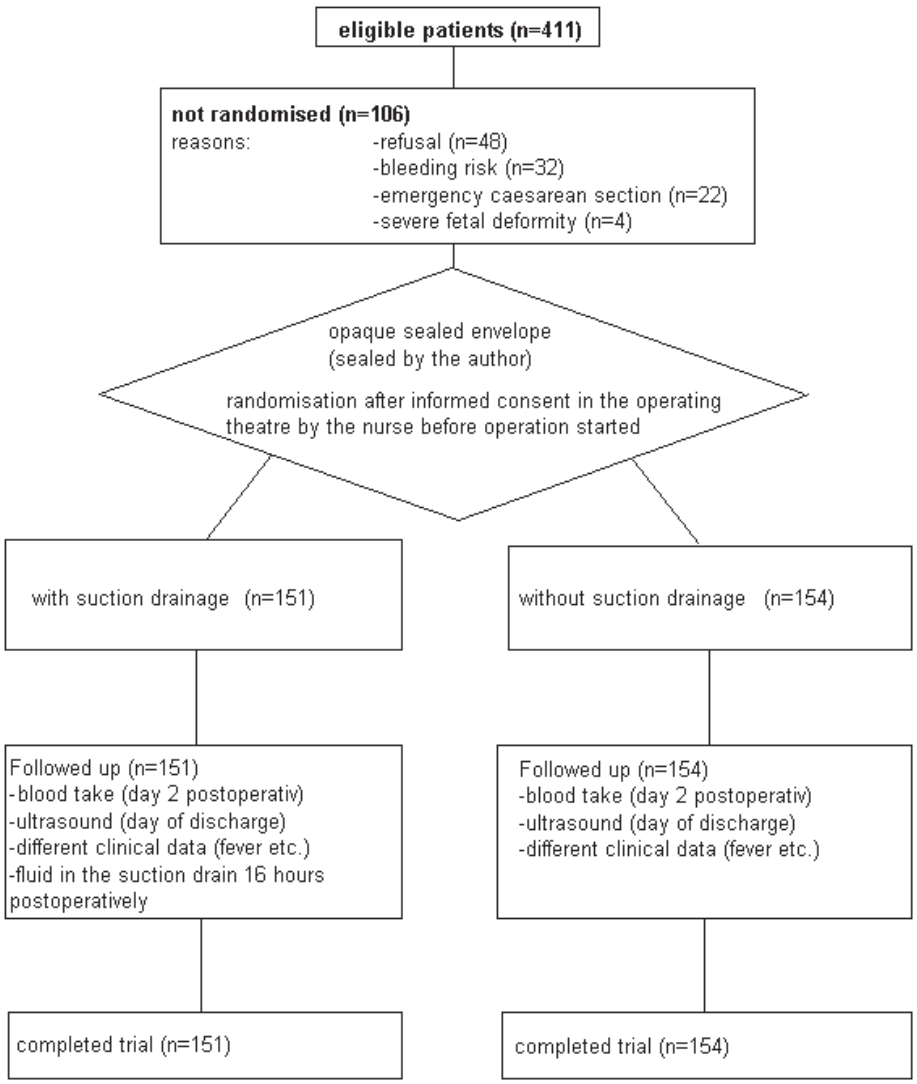


Figure 1

Flow chart describing progress of patients through randomised trial.

Results

The groups were similar in age, parity and gestational age and the kind of caesarean section (table 1). After randomisation no patient had to be excluded from the study. In the control (suction) group, mean drainage volume 16 hours postoperatively was 29.8 ± 20.0 ml (range: 0–125 ml) (figure 2). There was no fever in either group. Decrease in Hb was similar in both groups (figure 3). Opiate use was lower in the no-suction group (2.8 ± 1.4 *vs* 4.5 ± 1.8 injections, p = 0.0001) (figure 4). Sonographic haematoma rates (no-suction group: n = 4 *vs* controls: n = 5) were similar, and revision was required in one patient per group (no-suction group: wound dehiscence, with no intraoperative evidence of haematoma; suction group: haematoma). No wound infection was diagnosed in either group. Operation time was shorter in the no-suction group (32.7 ± 11.3 *vs* 36.1 ± 10.5 min, p = 0.0071) (figure 5), as was postoperative hospital stay (6.5 ± 2.4 *vs* 7.4 ± 2.8 days, p = 0.0058) (figure 6).

Figure 2

Suction group: Drainage flask volume 16 hours postoperatively.

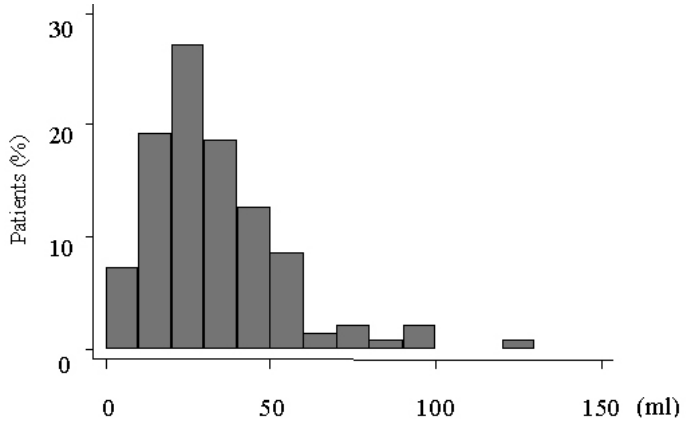


Figure 3

Decrease in postoperative hemoglobin.

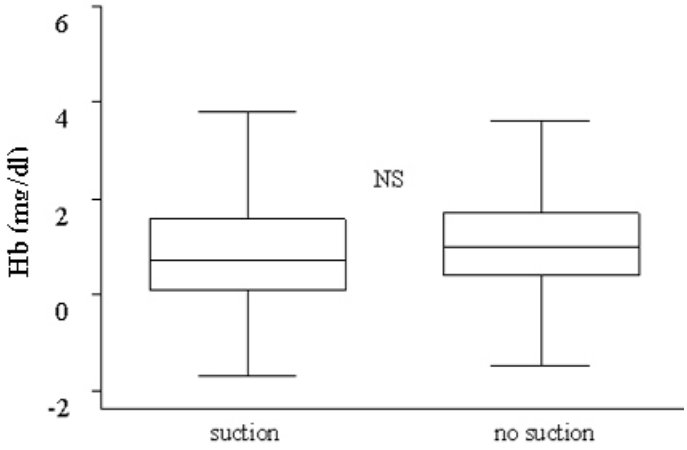


Table 1

Characteristics of no-suction group and controls.

Group	patients (n)	age (years)	parity	gestation (week)	elective caesarean
no suction	154	30.5 ± 5.6	1.6 ± 0.8	37.7 ± 3.0	98
suction	151	30.8 ± 5.5	1.6 ± 0.8	37.2 ± 3.0	99

Discussion

To our knowledge no study has specifically addressed the place of wound drainage under controlled current operating conditions in caesarean section. A 1970 study in general surgery found "great" benefit in genitourinary tract procedures, but only "some to fringe" benefit in a range of five other procedures (not including caesarean section) [7]. A 1984 study across 31 UK centres found an inferred 14% wound infection rate after caesarean section, prolonging hospital stay by a mean of 2.4

Figure 4

Opiate use. p = 0.0001

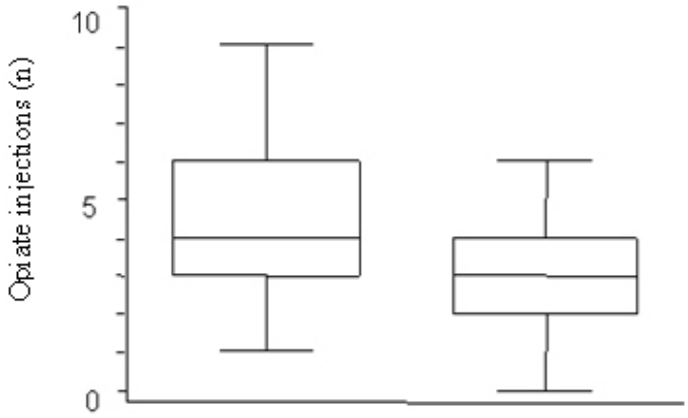


Figure 5

Operation time. p = 0.0071.
Left: suction; right: no suction.

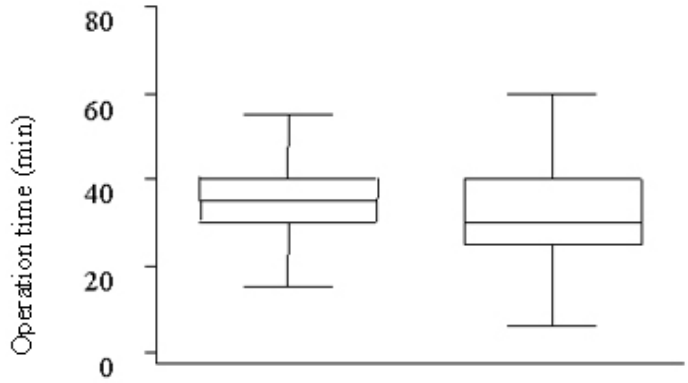
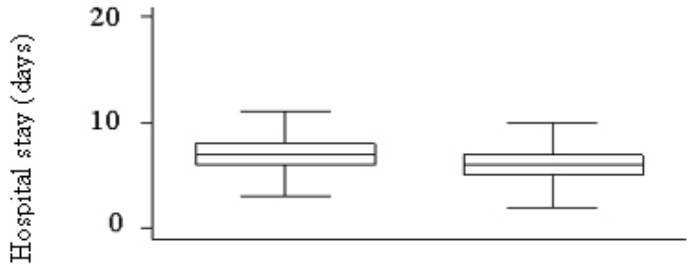


Figure 6

Hospital stay. p = 0.0058.
Left: suction; right: no suction.



days. Improved skin preparation and shorter operation times decreased the risk. Drainage, however, was associated with an increased risk, although this may have been because of an increased risk of bleeding [8]. A similar bias may have affected a 1988 randomised controlled study, also from the UK, which found no advantages in wound drainage after caesarean section but which allowed surgeons the option of excluding patients with increased perioperative bleeding [9].

For this reason our prospective study was conducted under controlled conditions in which the preoperative randomisation instruction was in no case countermanded by perioperative problems such as haemostasis. Additionally, the study was conducted under modern conditions of antibiotic prophylaxis with single-shot ceftriaxone [10], improved skin preparation, and minimal clean preoperative interventions which together ensured infection-free wound healing across all 305 sections. This is to be contrasted with the practice described in the above 1984 study with the inferred 14% infection rate, in which only 8% of the 2370 women received antibiotic prophylaxis [8]. Even the 1988 study showing that wound drainage significantly decreased the infection rate still did not use routine perioperative antibiotic prophylaxis [3]. More recently, two studies have shown that prophylactic antibiotic administration in patients undergoing caesarean section did not influence postoperative infectious morbidity [11, 12]. While in the study of Yip et al. all women received wound drainage, in the study of Bagratee et al. only about 50% of all women received one or two suction tubes after caesarean section. Taken together, these previous studies and our present one may indicate that with current operation techniques neither preoperative antibiotics nor wound drainage are absolutely necessary.

Our study found no significant disadvantage in the no-suction group: bleeding complications in terms of postoperative haemoglobin or sonographic haematoma were similar in both groups, as were the number of revisions. In fact the only significant differences between the no-suction and suction groups were advantages: no-suction pa-

tients had shorter operations, suffered less postoperative pain, and left hospital earlier, with clear cost savings in terms of suction systems, drug use and hospital stay.

Our findings do not necessarily contradict the established principle that body fluid stasis increases the risk of infection. Haemostasis was maintained in both groups primarily by careful surgical technique. The fact that postoperative drainage of capillary bleeding provided no added benefit confirms Halsted's cited: "Drainage is a confession of imperfect surgery: The more imperfect the technique of a surgeon the greater the necessity for drainage." [1]

Our study focused on pregnant women with low bleeding risk undergoing caesarean section. It shows that routine wound drainage in this group is not only useless and cost-ineffective but may do more harm than good. We now suspect that this conclusion may also apply to the patient group with a bleeding risk, a hypothesis we are currently testing in our department.

Correspondence:
Nadin Ochsenbein-Imhof MD
Dept. Obstetrics & Gynecology
Clinic of Obstetrics
Division of Perinatal Physiology
University Hospital of Zurich
Frauenklinikstr. 10
CH-8091 Zurich
E-mail: nadin.ochsenbein-imhof@fhk.usz.ch

References

1 Schumpelick V, Klever P, Tons C, Zeller H. [Drainage – materials and physical principles]. Chirurg 1993; 64: 77.
2 Grillo M, Riedel HH, Holler C. [Use of highly evacuated Redon drainage following gynecologic operations]. Zentralbl Chir 1987;112:729.
3 Loong RL, Rogers MS, Chang AM. A controlled trial on wound drainage in caesarean section. Aust N Z J Obstet Gynaecol 1988; 28:266.
4 Harder F, Rothenbuhler JM, Oertli D. [Drainage in surgery of infections]. Chirurg 1993;64:103.
5 Werner HP. [Complications and risks of suction drainage]. Z Gesamte Hyg 1990;36:94.
6 Smaill F, Hofmeyr GJ. Antibiotic prophylaxis for cesarean section (Cochrane review), vol Cochrane review. Oxford: Update Software: The Cochrane Library, 1998.
7 Maitland AI, Mathieson AJ. Suction drainage. A study in wound healing. Br J Surg 1970;57:193.
8 Moir Bussy BR, Hutton RM, Thompson JR. Wound infection after caesarean section. J Hosp Infect 1984;5:359.
9 Saunders NJ, Barclay C. Closed suction wound drainage and lower-segment caesarean section. Br J Obstet Gynaecol 1988; 95:1060.
10 Jakobi P, Weissman A, Sigler E, Margolis K, Zimmer EZ. Post-cesarean section febrile morbidity. Antibiotic prophylaxis in low-risk patients. J Reprod Med 1994;39:707.
11 Yip S, Lau T, Rogers M. A study on prophylactic antibiotics in caesarean sections – is it worthwile? Acta Obstet Gynecol Scand 1997;76:547.
12 Bagratee J, Moodley J, Kleinschmidt I, Zawilski W. A randomized controlled trial of antibiotic prophylaxis in elective caesarean delivery. Br J Obstet Gynecol 2001;108:143.

Swiss
Medical Weekly

Official journal of
the Swiss Society of Infectious disease
the Swiss Society of Internal Medicine
the Swiss Respiratory Society

The many reasons why you should choose SMW to publish your research

What Swiss Medical Weekly has to offer:

- SMW's impact factor has been steadily rising, to the current 1.537
- Open access to the publication via the Internet, therefore wide audience and impact
- Rapid listing in Medline
- LinkOut-button from PubMed with link to the full text website http://www.smw.ch (direct link from each SMW record in PubMed)

- No-nonsense submission – you submit a single copy of your manuscript by e-mail attachment
- Peer review based on a broad spectrum of international academic referees
- Assistance of our professional statistician for every article with statistical analyses

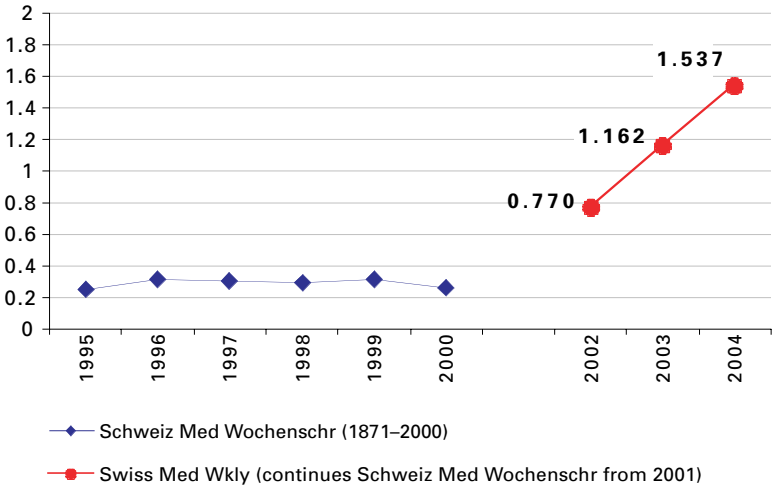
- Fast peer review, by e-mail exchange with the referees
- Prompt decisions based on weekly conferences of the Editorial Board
- Prompt notification on the status of your manuscript by e-mail
- Professional English copy editing
- No page charges and attractive colour offprints at no extra cost

We evaluate manuscripts of broad clinical interest from all specialities, including experimental medicine and clinical investigation.

We look forward to receiving your paper!

Guidelines for authors:
http://www.smw.ch/set_authors.html

Impact factor Swiss Medical Weekly



EMH FMH Schwabe
Editores Medicorum Helveticorum

All manuscripts should be sent in electronic form, to:

EMH Swiss Medical Publishers Ltd.
SMW Editorial Secretariat
Farnsburgerstrasse 8
CH-4132 Muttenz

Manuscripts: submission@smw.ch
Letters to the editor: letters@smw.ch
Editorial Board: red@smw.ch
Internet: http://www.smw.ch