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Drains thoraciques en Réanimation. Comparaison des méthodes Seldinger et chirurgicale. Étude rétrospective multicentrique

Florine Bernicola

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UNIVERSITÉ CLERMONT AUVERGNE
UFR DE MÉDECINE ET DES PROFESSIONS PARAMÉDICALES

THÈSE D'EXERCICE
pour le
DIPLÔME D'ÉTAT DE DOCTEUR EN MÉDECINE
par

BERNICOLA Florine, Ghislaine, Pauline

Présentée et soutenue publiquement le 24 octobre 2019

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Directeur de thèse

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Data are presented as mean \pm SD or number (%), unless otherwise noted. *Abbreviations:* BMI: body mass index; MV: mechanical ventilation; ICU: intensive care unit; IQR: interquartile range; SAPS: simplified acute physiology score; SD: standard deviation.

Table 2. Characteristics of drainages

Data are presented as mean \pm SD or number (%). *Abbreviations:* CH: Charrière; CT-scan: computed tomography-scan; F: French; SD: standard deviation.

Table 3. Drainages complications

Data are presented as mean \pm SD or number (%).

‡ Gaz exchange impairment is defined as the need for control ventilation or intubation following or during drainage procedure.

€ Drain blockage occurred after 1.3 ± 1.8 and 0.8 ± 2.1 days in the Seldinger and surgical groups, respectively ($p=0.42$).

¥ Drain fall occurred after 0.3 ± 0.6 and 0.8 ± 2.0 days in the Seldinger and surgical groups, respectively ($p=0.49$).

Table 4. Complications according to prior US examination or not

Data are presented as mean \pm SD or number (%). *Abbreviations:* NA: not applicable; US: ultrasound.

Table 5. Characteristics of drainages conducted during day and night times

Data are presented as mean \pm SD or number (%). *Abbreviations:* NA: not applicable; US: ultrasound.

Table 6. Drainages associated pains

Data are presented as mean \pm SD or number (%). *Abbreviations:* BPS: behavioral pain score; RASS: Richmond agitation sedation scale; VNS: visual numerical scale.

Table 7. Summary of studies included in the meta-analysis

Data are presented as mean \pm SD or number (%). *Abbreviations:* (L): large bore-drain; (S): small bore-drain; ICU: intensive care unit; ED: emergency department.

FIGURES

Figure 1. Drainages complications

Data are presented as mean \pm SD or number (%).

Figure 2. Flow diagram of meta-analysis

Figure 3. Forest plot for the risk of complications according to Seldinger and surgical methods

The size of the data markers indicates the weight of the study in the final analysis. Data are presented as pooled relative ratios (RR) with pertinent 95% confidence intervals (CI).

Figure 4. Forest plot for the risk of major bleeding according to Seldinger and surgical methods

The size of the data markers indicates the weight of the study in the final analysis. Data are presented as pooled relative ratios (RR) with pertinent 95% confidence intervals (CI).

Figure 5. Forest plot for the risk of organ injury according to Seldinger and surgical method

The size of the data markers indicates the weight of the study in the final analysis. Data are presented as pooled relative ratios (RR) with pertinent 95% confidence intervals (CI).

Figure 6. Forest plot for the risk of empyema according to Seldinger and surgical method

The size of the data markers indicates the weight of the study in the final analysis. Data are presented as pooled relative ratios (RR) with pertinent 95% confidence intervals (CI).

Figure 7. Forest plot for the risk of malposition according to Seldinger and surgical method

The size of the data markers indicates the weight of the study in the final analysis. Data are presented as pooled relative ratios (RR) with pertinent 95% confidence intervals (CI).

Figure 8. Forest plot for the risk of dislodgement according to Seldinger and surgical method

The size of the data markers indicates the weight of the study in the final analysis. Data are presented as pooled relative ratios (RR) with pertinent 95% confidence intervals (CI).

Figure 9. Forest plot for the risk of drainage failure according to Seldinger and surgical method

The size of the data markers indicates the weight of the study in the final analysis. Data are presented as pooled relative ratios (RR) with pertinent 95% confidence intervals (CI).

Figure 10. Forest plot for the risk of pneumothorax according to Seldinger and surgical method

The size of the data markers indicates the weight of the study in the final analysis. Data are presented as pooled relative ratios (RR) with pertinent 95% confidence intervals (CI).

Figure 11. Forest plot for the risk of blockage according to Seldinger and surgical method

The size of the data markers indicates the weight of the study in the final analysis. Data are presented as pooled relative ratios (RR) with pertinent 95% confidence intervals (CI).

Figure 12. Forest plot for the risk of success according to Seldinger and surgical method

The size of the data markers indicates the weight of the study in the final analysis. Data are presented as pooled relative ratios (RR) with pertinent 95% confidence intervals (CI).

LIST OF ABBREVIATIONS

BMI: Body mass index

BPS: Behavioral pain scale

BTS: British Thoracic Society

CT-scan: Computed tomography-scan

CHU: Centre hospitalier universitaire (University hospital)

CI: Confidence intervals

ED: Emergency department

ICU: Intensive care unit

IQR: Interquartile range

LOS: Length of stay

MV: Mechanical ventilation

NIV: Non-invasive ventilation

RASS: Richmond analgesia-sedation scale

SAPS II: Simplified acute physiology score II

SD: Standard deviation

US: Ultrasound

VNS: Visual numeric scale

Comparison of Seldinger and surgical techniques of pleural drainage in Intensive Care Units. A nationwide multicentre retrospective study.

Authors: Thomas Godet, MD, PhD¹, Renaud Guérin, MD¹, Florine Bernicola, MSc¹, Thomas Rimmelé, MD, PhD², Baptiste Hengy, MD², Florent Sigwalt², Carole Ichai, MD, PhD³, Hervé Quintard, MD³, Jérémy Bourenne, MD⁴, Marc Gainnier, MD, PhD⁴, Gauthier Arpajou, MD¹, Jules Audard, MD¹, Sophie Cayot, MD¹, Matthieu Jabaudon, MD, PhD^{1,5}, Camille Verlhac, MD¹, Bruno Pereira, PhD⁶, Jean-Etienne Bazin, MD, PhD¹, Emmanuel Futier, MD, PhD^{1,5}, Jean-Michel Constantin, MD, PhD^{1,5}

Author's Affiliations:

¹ Centre Hospitalier Universitaire (CHU) de Clermont-Ferrand, Département de Médecine Périopératoire (MPO), Clermont-Ferrand, F-63003, France

² Hospices Civils de Lyon (HCL), Hôpital Edouard Herriot, Département d'Anesthésie-Réanimation, Lyon, F-69000, France

³ Centre Hospitalier Universitaire (CHU) de Nice, Département d'Anesthésie-Réanimation, Nice, F-06000, France

⁴ Centre Hospitalier Universitaire (CHU) de Marseille, Réanimation des Urgences, Service de Médecine Intensive et Réanimation, Marseille, F-13000, France

⁵ GReD; UMR/CNRS6293; Université Clermont-Auvergne; INSERM U1103, Clermont-Ferrand, F-63003, France

⁶ Centre Hospitalier Universitaire (CHU) de Clermont-Ferrand, Délégation à la Recherche Clinique et à l'Innovation (DRCI), Clermont-Ferrand, F-63000, France

ABSTRACT

Background: Pleural drainage is common practice in intensive care units (ICU). Indications include parapneumonic and transudative effusions, hemorrhage (post-traumatic or not), malignant pleural effusion, empyema and pneumothorax. Despite being associated with a small incidence of complications (ranging from 0 to 8%), some of those might become life threatening if associated with visceral puncture (liver, spleen, lung parenchyma or heart) or severe hemorrhage. Complications have been reported to be higher in case of large-bore chest drains inserted using the trocar technique. Small-bore chest tubes inserted with Seldinger technique are widely recommended by British guidelines published in 2010. However, complications associated with each type of drainage remain uncertain to date and multicentre studies are lacking.

Methods: We have conducted a nationwide multicentre retrospective study in five ICUs of French university hospitals. Included patients required chest drain insertion whatever the indication. Complications associated with small- or large-bore drains were collected: visceral injury, drain malposition, empyema, infection, among others. Technical skills of practitioners were reviewed as well as volume and consistence of drained effusion. Procedural associated pains were evaluated. We also added a systematic review of the literature and conducted a meta-analysis on reported complications in each group.

Results: Two hundred and seven consecutive ICU patients requiring pleural drainage were included. Indications were similar between both techniques. Interestingly, small drains inserted *via* Seldinger technique were preferentially preceded by ultrasound examination (93 (89%) vs 80 (79%), $p=0.004$) and inserted under US guidance (13 (13%) vs 0, $p<10^{-3}$). Insertion difficulty and drain malposition were comparable. Complication's rates were similar between groups despite concerning drain blockage, which was more frequent with small drains (9 (9%) vs 0, $p=0.008$). Effusion production after drain release (6 (6%) vs 0, $p=0.01$) conducted to restricted volumes ($93\pm 184\text{mL}$). The need for subsequent drainage after initial

drain removal was equivalent (5 (5%) vs 8 (8%), $p=0.42$). Per-procedural pain was worse during large-bore drains' insertion (BPS 3.7 ± 1.6 vs 5.5 ± 2.2 , $p<10^{-3}$) despite systematic local anaesthesia. Meta-analysis, mainly based on low quality studies, conducted to equivalent incidences of complications between groups.

Conclusions: In our cohort, Seldinger and surgically inserted thoracic drains carry similar complications' rates in ICU patients. Per-procedural pain was lower in the group of small-bore drains. Further studies are required to evaluate complications associated with thoracic drainage techniques on a larger scale.

Trial Registration: IRB 00010254-2018-058, CERAR (Comité d'éthique pour la recherche en Anesthésie-Réanimation, Société Française d'Anesthésie-Réanimation), April 1st, 2018

Keywords: Chest drainage, Seldinger, Surgical technique, ICU patients, Mechanical Ventilation, Complications

Words: 378

BACKGROUND

Percutaneous pleural drainage is the third most frequent procedure in Intensive Care Units (ICU) (1–3). The optimal technique to conduct pleural drainage remains controversial (4). Two techniques are currently available: Seldinger method for small (pigtailed) drains and surgically inserted large chest tubes. Only one international recommendation has been published to date. The British guidelines released by the British Thoracic Society in 2010 in *Thorax* argue for the widest use of Seldinger technique over surgical one (5). Indeed, based on few retrospective and non-randomized prospective studies, complications' incidence seems to be lower in Seldinger arm (5). Complications occur in 0 to 8% of chest drain insertion cases. Main complications associated with small-bore chest tubes are drain blockage, empyema, malposition, visceral injury and drain dislodgement. Complications associated with large-bore chest tubes are malposition, drain blockage, pain, drain-related visceral injuries and empyema.

Type of chest tube choice is usually guided by drainage's indication or practitioners' habits and/or experience. Indications comprise parapneumonic and transudative effusions, hemorrhage (either post-traumatic or not), malignant pleural effusions, empyema and pneumothoraces. A recent international survey endorsed by the ESICM (European Society of Intensive Care Medicine) has reported wide differences in the management of primary spontaneous pneumothoraces by intensivists (6), despite published recommendations (5). Small-bore chest tubes might be preferred in the case of liquid pleural effusions or pneumothoraces (7,8), while thick-suspected effusions like empyema or blood (9) would urge the use of large-bore ones, especially after thoracic trauma (10), despite recent retrospective data concluding on the potential non-inferiority of 14Fr pigtail catheters compared to chest tubes (11). However, results of retrospective or prospective small analyses might suggest the polyvalent and efficient use of small-bore chest tubes in any of these indications without increasing complications rates such as drain blockage (5).

Seldinger technique requires puncture of pleural cavity with a Tuohy needle, guidewire insertion and small-bore drain placement after dilatation. Surgical technique requires progressive chest wall blunt dissection and large-bore chest tube insertion with fitted trocar. Both drains must be placed within the safety triangle (5) which is bordered anteriorly by the lateral edge of pectoralis major, laterally by the lateral edge of latissimus dorsi, inferiorly by the line of the fifth intercostal space and superiorly by the base of the axilla.

Main life-threatening complication is *per*-procedure organ injury, possibly leading to severe and unstoppable hemorrhage. British guidelines urge physicians to use ultrasound (US) examination prior to chest drainage and possibly to guide insertion (5). This examination could help to determine pleural effusion volume and location as well as alongside organs' identification (spleen, liver, lung...) to avoid injuries (12).

To our knowledge, no large randomized controlled trial (RCT) has been conducted or planned to compare complications associated with both techniques and their respective efficiencies. To determine outcomes and evaluate the number of patients needed to treat, identification of associated complications incidences is required. Benefits related to the choice of chest drainage technique in ICU patients are potentially important in terms of complications as well as procedures' associated pain (7,13). Therefore, the definitive aim of the present retrospective nationwide multicentre study is to investigate complications associated with chest drainage techniques in ICU patients.

METHODS/DESIGN

Ethics

The present retrospective study was approved by French research ethics board (CERAR, Comité d'Ethique pour la Recherche en Anesthésie-Réanimation) of the Société Française d'Anesthésie-Réanimation (SFAR). Obtained approval number is IRB 00010254-2018-058 on April 1st, 2018. The need for written informed consent was waived.

The presented meta-analysis has not been registered in Prospero or in another dedicated database.

Study design, settings and population

The present retrospective study is an investigator-initiated, nationwide, multicentre, retrospective study. Five university hospitals adult ICUs participated. Four of them were mixed medical/surgical ICUs, the remaining one medical, and are located in major French cities (Nice, Lyon, Marseille and Clermont-Ferrand). Three of them enrolled their last 20 consecutive chest drainages, and one 18. The last centre included 129 chest drainages. Inclusions were conducted between January 1st, 2018 and September 30th, 2018. To include patients, centres had to routinely use both techniques (Seldinger and surgical) in their units. Enrolling ICUs were staffed by board certified intensivists, had in-house coverage by clinical associates or resident trainees, and had availability of after-hours intensivist coverage. Data were recorded using an Excel (Microsoft) based table and were filled according to patients' electronic record data.

Summary of Outcomes

The primary outcome was a composite of complications related to chest insertion, whatever the type: solid organ injury, hemorrhage (intern or chest wall), infection (site

insertion or pleural cavity), drain blockage and drain dislodgement. In addition, each component of the primary outcome measure has been analysed separately.

Secondary outcomes were related with:

- Isolated complications of primary outcome composite score
- Patients' outcomes (ICU length of stay (LOS), mechanical ventilation days)
- Drainage characteristics (indication, type of fluid drained, difficulty, volume, drain position)
- Characteristics of physician (senior or in training)
- Off hours procedure
- Post-procedure control: US, CT-scan and radiography uses
- Procedure related pains (in a single center)

Junior supervised operators were resident tightly supervised by surgically dressed senior intensivist who guided the procedure step by step. Junior operators were ICU residents with previous experience of at least ten supervised chest drainages. Extra thoracic, intrafissural or intraparenchymal chest tubes were considered as malpositioned according to chest X ray or CT-scan.

Per-procedure pain evaluation and report was only conducted in a single center (n= 129) as required by local protocol: analgesia (BPS, behavioral pain scale or 10 points VNS, visual numeric scale) and sedation (RASS, Richmond agitation-sedation scale) scores were collected before, during and after any potentially painful procedures.

Meta-analysis

We supplemented our study with a meta-analysis. The aim was to compare drainage techniques in terms of complications.

One author independently searched PubMed and Cochrane Central Register up to September 1st, 2019 for adult trials comparing both modalities of drainage (Seldinger and surgical). The following Medical Subject Headings (MeSH) and keywords were used: "chest

tubes” or “drainage” or “tube thoracostomy” or “pigtail catheter” AND “pneumothorax” or “hemothorax” or “pleural effusion” or “malignant pleural effusion” or “empyema” AND “complications” or “outcomes”. Finally, references of retrieved articles and pertinent reviews were scanned to detect further studies.

We included randomized controlled trials (RCT) that compared small-bore (Seldinger inserted) and large-bore chest tubes in adults. We also considered prospective observational studies and retrospective trials. No minimum sample size was required. Studies in ICU, Emergency department (ED) or medical wards settings were included. Conference abstracts, reviews, non-English language studies, non-human studies, protocols, policy statements and guidelines were excluded. Pediatric and neonates studies were excluded. Studies on healthy patients were also excluded. Drains inserted in the per-operative context during thoracic or cardiac surgery, by surgeons, were not included.

For each study, the risk of bias was assessed using the appropriate Cochrane methods and reported as low, unclear or high regarding sequence generation, allocation, concealment, blinding of participants, blinding of outcome assessment, incomplete outcome data, selective outcome reporting, and other potential source of bias. We used the Cochrane Collaboration Risk of Bias Tool for RCT (14), the Good ReseArch for Comparative Effectiveness (GRACE) (15) and the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) recommendations for observational studies (16), to summarize the quality of evidence for each study.

Statistical analysis

Statistical analyses were conducted using Prism software (version 7.0b, Graphpad) and Stata software (version15, StataCorp, College Station). A two-sided p value of less than 0.05 was considered to indicate statistical significance. Categorical parameters were analysed using Chi2 or Fisher’s exact tests in univariate analysis. Comparison between groups were conducted using Student’s t-test or Mann-Whitney U test. Normality was studied

by the Shapiro-Wilk test and homoscedasticity using the Fisher-Snedecor test. To take into account center effect, random-effects models were performed with center as random effect. More precisely, to compare complications between two groups, generalized linear mixed model (with logit link function for dichotomous endpoint) were performed. To adjust for potential baseline differences between the two groups (Seldinger and surgically inserted drains), a propensity score analysis was also performed to predict the conditional probability for an individual patient to receive drain. According to sample size and the occurrence of events associated to endpoints, inverse probability of treatment weighting (IPTW) used weights, based on the propensity score, to create a synthetic sample in which the distribution of measured baseline covariates was independent of group assignment. The covariates included in the propensity score model were determined according to univariate results and clinical relevance: SAPS II, physician experience in chest drainage (junior, junior supervised or senior), hemothorax drainage, hemo-pneumothorax drainage, US use prior to drain insertion and center. As less than 5% of data was missing, handling of missing data was not applied.

Meta-analysis statistics were conducted using Open Meta-Analyst software. Baseline characteristics were summarized for each study sample and reported as mean (standard deviation) and number (%) for continuous and categorical variables respectively. Each endpoint and 95% confidence intervals were estimated using random-effects models assuming between and within study variability (DerSimonian and Laird approach). Statistical heterogeneity between results was assessed by examining forest plots, confidence intervals and using I^2 , which is the most common metric for measuring the magnitude of between-study heterogeneity and is easily interpretable. I^2 values range between 0% and 100% and are typically considered low for <25%, modest for 25–50%, and high for >50%. This statistical method generally assumes heterogeneity when the p-value of the I^2 test is <0.05. Results were expressed as relative risks, standardized mean differences (SMD) and 95% confidence intervals. A scale for SMD has been suggested with 0.8 reflecting a large effect,

0.5 a moderate effect, and 0.2 a small effect. Type I-error was fixed at $\alpha=0.05$. RCTs and observational studies were evaluated according to Jadad scoring system and GRACE or STROBE checklists, respectively.

RESULTS

Two hundred and seven consecutive drainages were retrospectively included in the study over a period of nine months. The median (IQR) patients' ages were 63 (51-73) years, 65% were male, mean (SD) body mass index (BMI) was 24.5 (4.8) kg.m⁻² and mean (SD) admission SAPS II was 46 (18). Data are presented in **Table 1**. For the entire cohort the number of missing values ranged from 0 (0.0%) to 7 (3.4%) with the majority below 1%.

Death in ICU, post drainage mechanical ventilation (MV) days and ICU length of stay were similar between the two groups (**Table 1**). Duration of post drainage MV (6.5 (11.8) vs 6.8 (11.1) days, $p=0.79$) and modalities (NIV (89 (85%) vs 16 (15%), $p=0.07$) or invasive (76 (75%) vs 26 (25%), $p=0.07$)) were comparable between Seldinger and surgical groups, respectively.

Among patients requiring chest drainage, indications were as presented in **Table 2**. Main indication was pleural effusion (79 (75%) vs 69 (68%), $p=0.06$, in Seldinger and surgical groups, respectively). Pneumothoraces drainages were second indications (20 (19%) vs 13 (13%), $p=0.06$). Notably, no significant difference between the two techniques was observed for hemothoraces (3 (3%) vs 10 (10%), $p=0.051$) and hemo-pneumothoraces (2 (2%) vs 8 (8%), $p=0.051$) drainages. Adding those two entities, difference rose between the two groups (5 (5%) vs 18 (18%), $p=0.005$), in the Seldinger and surgical groups, respectively. Two empyema were drained in the surgical group (0 (0%) vs 2 (2%), $p=0.16$).

Operator characteristics were similar between groups with procedures equally distributed between senior (34 (32%) vs 34 (33%), $p=0.88$), supervised junior (41 (39%) vs 31 (30%), $p=0.11$) and confirmed junior intensivists (30 (29%) vs 37 (36%), $p=0.37$), between Seldinger and surgical groups, respectively (**Table 2**).

Ultrasound use prior to chest drain insertion was more frequent in Seldinger group (93 (89%) vs 80 (78%), $p=0.004$). According to this examination, predicted volumes of pleural effusion were similar (744±335 vs 670±301 mL, $p=0.37$). Small bore chest tubes inserted

following Seldinger technique were more likely to be done under US guidance (13 (13%) vs 0 (0%), $p < 10^{-3}$).

Difficulties to insert chest tubes were similar between groups (**Table 2**). Most of drains were easily inserted (75 (71%) vs 75 (74%), $p=0.74$). Moderate and important difficulties were observed in (25 (24%) vs 22 (22%), $p=0.54$) and (4 (4%) vs 5 (5%), $p=0.77$), respectively. Drainage failures were similar between groups (6 (6%) vs 2 (2%), $p=0.14$), as well as the need for a second operator (4 (4%) vs 3 (3%), $p=0.67$) and the requirement of a drainage method crossover (3 (3%) vs 0 (0%), $p=0.08$). Complications rates were similar between groups despite for a higher frequency of drain blockage in the Seldinger group (9 (9%) vs 1 (1%), $p=0.008$). No organ lesion and no post-procedure hemothorax, pyothorax or wound infection were observed in our cohort. Post procedure pneumothoraces detected by chest X-ray (2 (2%) vs 1 (1%), $p=0.54$), persistent bubbling (3 (3%) vs 4 (4%), $p=0.73$), parietal hemorrhage (1 (1%) vs 1 (1%), $p=0.98$), bleeding after drain removal (1 (1%) vs 1 (1%), $p=0.98$), drain dislodgement (4 (4%) vs 3 (3%), $p=0.67$) and effusion recurrence requiring a second drain insertion (5 (5%) vs 8 (8%), $p=0.42$) were similar between Seldinger and surgical groups, respectively. Overall complications rates were equivalent between Seldinger and surgical groups (28 (28%) vs 22 (21%), $p=0.28$). Results are shown in **Table 3** and **Figure 1**. Results considering centers as random effect confirmed univariate analyses.

Complications (visceral injury, parietal hemorrhage, empyema and malposition) were similar between two groups: prior US examination vs no prior US examination (**Table 4**).

Post procedure control of drain position was equivalent between Seldinger and surgical groups. Interestingly, only a third of patients had chest X-ray (35 (34%) vs 40 (38%), $p=0.57$). One single patient in Seldinger group had post procedure US control and few had CT-scan control (6 (6%) vs 3 (3%), $p=0.29$).

Drained volumes were similar immediately after drain placement (504±460 vs 654±1016 mL, $p=0.17$), after 24 hours (865±724 vs 982±1102 mL, $p=0.38$) and before drain removal (1612±3385 vs 1734±2107 mL, $p=0.77$). Drain maintenance was similar between

groups (4.8 ± 3.0 vs 5.1 ± 3.4 days, $p=0.54$).

Characteristics of drained fluids differed between groups. Effusions were more likely to be clear liquids in the Seldinger group (54 (53%) vs 40 (38%), $p=0.03$) while blood was more often found in the surgical group (5 (5%) vs 21 (20%), $p=0.001$), and air in the Seldinger group (22 (22%) vs 7 (7%), $p=0.002$). Similar amount of sero-hematic, bilious and not reported drained fluids were found between groups (**Table 2**).

Many procedures were conducted during out-of-hours (64 (31%), equally using both techniques (**Table 5**). Off hours drainages were less frequently preceded by US examination than during daytime (45 (70%) vs 128 (90%), $p=0.001$), but drainage difficulty and complications' rates were similar.

Surgically inserted drains were associated with worst per-procedure pain scores (**Table 6**), as evaluated by BPS in non-communicating patients (3.7 ± 1.6 vs 5.5 ± 2.2 , $p<10^{-3}$) while VNS were similar (4.9 ± 2.6 vs 5.1 ± 3.1 , $p=0.82$) in communicating patients, in Seldinger and surgically inserted groups, respectively. No clinically relevant change in sedation score (RASS) was observed. Medications changes were more frequent in surgical group (2 (3%) vs 10 (16%), $p=0.01$).

IPTW results based on propensity score, conducted to similar conclusions with a single significant difference for drain blockage ($p=0.02$), while all other complications rates were similar: drainage failure ($p=0.09$), need for a second operator ($p=0.43$), technique crossover ($p=0.08$), post-procedure pneumothorax ($p=0.66$), persistent bubbling ($p=0.93$), parietal hemorrhage ($p=0.30$), removal bleeding ($p=0.94$), drain dislodgment ($p=0.77$), or effusion recurrence with drainage ($p=0.67$).

In our meta-analysis, we evaluated full texts of 760 studies (PubMed and Embase). **Figure 2** shows the flow diagram. Duplicate studies were removed and we further excluded studies because these did not meet inclusion criteria (only one type of drain evaluated, pediatric or neonatal population and postoperative period). Ultimately, 14 trials were included

in the final analysis with 2579 patients which received 2583 drains (1093 patients with small bore catheters and 1480 patients with large bore drains). On the 14 trials, 3 were randomised controlled trials and 11 were observational studies (**Table 7**).

The surgical method (68/1154) was associated with fewer overall complications (major or minor) compared to the Seldinger method (86/569), RR=1.82, 95% CI [1.13-2.95], $p=0.048$ and $I^2=79\%$. Results are shown in **Figure 3**. Major bleeding occurrence was similar between Seldinger and surgical group (10/483 vs 4/786, respectively; RR=1.66, 95% CI [0.57-4.8], $p=0.53$, $I^2=0\%$ (**Figure 4**). Similarly, no significant differences were found for organ injury (2/425 vs 2/591, respectively; RR=1.44 95% CI [0.298-6.917], $p=0.74$, $I^2=0\%$ (**Figure 5**), empyema (5/240 vs 1/227, respectively; RR=1.82, 95% CI [0.43-7.6], $p=0.79$, $I^2=0\%$ (**Figure 6**), malposition (10/490 vs 12/1089, respectively; RR=2.28, 95% CI [0.99-4.99], $p=0.58$, $I^2=0\%$ (**Figure 7**), dislodgment (9/512 vs 13/1116, respectively; RR=1.47, 95% CI [0.61-3.57], $p=0.38$, $I^2=82\%$ (**Figure 8**), drainage failure (90/500 vs 151/1006, respectively; RR=1.06, 95% CI [0.63-1.79], $p=0.01$, $I^2=78\%$ (**Figure 9**), pneumothorax (29/240 vs 29/265, respectively; RR=0.95, 95% CI [0.43-2.1], $p=0.12$, $I^2=82\%$ (**Figure 10**), drain blockage (7/231 vs 4/448, respectively; RR=3.99, 95% CI [0.27-59.29], $p=0.046$, $I^2=83\%$ (**Figure 11**) and success of chest drain insertion (180/226 vs 423/473, respectively; RR=1.06, 95% CI [0.87-1.29], $p=0.08$, $I^2=80\%$ (**Figure 12**).

DISCUSSION

The choice of chest drainage technique remains controversial between physicians and mainly relies on experiences and often unproven beliefs. In our cohort, small-bore chest tubes inserted following Seldinger technique were preferably chosen to drain pneumothoraces and clear or sero-hematic effusions. On the contrary, surgically inserted large chest tubes were mainly selected to drain blood from suspected hemothoraces. However, recent publications have reported similar rates of complications between pigtailed and surgically inserted drains to treat traumatic hemothoraces or hemo-pneumothoraces (11). The only significant difference found in our cohort in term of complication was drain blockage, which was 9 times more frequent in Seldinger group, in accordance with previous reports (17). However, this complication is believed to have few consequences on patient's outcomes. No infection related to drain opening or disconnection to allow flushing was identified in our cohort. Interestingly, after drain release, very little amounts of fluids were recovered (93 ± 184 mL), possibly illustrating a misinterpretation of blockage in place of a complete pleural effusion purge (dry pleural cavity). Swinging drained fluid could have allowed comparison of those two circumstances (18). Following those preliminary results, complications appear equivalent between both groups (Seldinger and surgical techniques). Rates were similar to those reported in previous studies and BTS recommendations (5).

US examination prior to drainage procedure was more frequent in Seldinger group. In our cohort, US examination was not associated with fewer complications. US current belief is that surgically inserted chest drains might be safely positioned *via* blunt dissection thus limiting possible injuries and misplacements. US has excellent accuracy in detecting pneumothorax and hemothorax in adults especially in traumatic settings (19) and might help draw a distinction between alveolar collapse (atelectasis) and pleural effusions, as determined by conventional chest X-rays or clinical examination. Moreover, US examination helps to optimise drain insertion site delimitating safe room with organs such as lung, liver

and spleen (20–24). US helps determining volumes of pleural effusions (25–29) and might help to anticipate fluid characteristics and discriminate clear, thick or bloody fluids (30,31). Despite BTS recommendations (5), US guidance remains scarce during puncture site selection and drain placement of Seldinger drains. This last feature necessitates specific skills and does not drop complications rates observed in the absence of real time needle guidance (32,33).

The use of large bore chest tubes has been associated with worse procedural and post-procedural pains, as compared with pigtail drains (5,34). Our study retrieved transient similar effects conducting to more frequent medication changes to relieve procedural pain in surgical group, despite systematic -but possibly not perfect- injection of lidocaine prior to drain insertion and chest dissection. No localized persistent pain was reported in the entire cohort.

Strengths and weaknesses

Main strength of the present study is the nationwide multicentre fashion including five French ICUs and leading to the largest retrospective study on the subject. Interesting data from US use during procedure are reported confirming the need for improvements in this field, as stipulated by BTS guidelines (5). Investigation of procedure related pain is an original feature of our work; despite being reported in a single center. Complications during off hours drainages were also collected and were similar to those conducted during daytime, whatever the operator or the type of drain.

However, our study has several limitations. The retrospective design is the major limit. Our study was intended to elucidate complications rates associated with both drainage techniques. No severe complication has been reported confirming the small incidence rate not overcome by the cohort size. Less severe complications might have been dropped by prior preferred selection of drainage technique by physicians in charge (e.g. large chest tubes in case of hemothoraces, even unrelated to trauma). We lack data on patients'

histories or medications impacting blood coagulation. Ventilation status is also imprecise. Possible reporting bias was controlled by asking physicians to collect *consecutive* drainages without any selection.

Meta-analysis

The meta-analysis shows a statistically significant difference in favour of the surgical group when considering all complications. However, heterogeneity may render interpretation of our results uncertain ($I^2=79\%$, $p=0.048$). Multiple indications for drainage were reviewed (7 trials focused on pneumothoraces, 3 on hemothoraces, 4 on transudative effusions, 3 on parapneumonic effusions or empyema and 4 on malignant effusions). In addition, statistical analysis concerns a small number of patients, global quality of included studies is poor (**Table 1 and 2 in Appendix**) and only one author participated in the qualitative analysis. No statistically significant difference between the two groups was found when each complication was examined separately. This therefore supports our project to carry out a prospective, randomized and multicenter study to answer this question and potentially provide guidelines to ICU physicians.

CONCLUSION

The present retrospective study on chest drainage techniques was unable to draw differences in terms of complications between Seldinger and surgically inserted chest tubes in ICU. Complications rates were low, ranging from 0 to 9%, in line with previous reports. Pain was however larger during surgical insertion of large bore tubes despite systematic local anaesthesia. This study urges for the conduct of a large multicentre randomized trial, in line with the low level of evidence reported in the 2010 recommendations of the British Thoracic Society on pleural procedures and thoracic ultrasound.

CONCLUSION

Les taux de complications liées au drainage pleural des patients de réanimation ou unité de soins continus retrouvés dans notre cohorte multicentrique rétrospective sont compris entre 0 et 9%, en accord avec la littérature, et dépendent de la technique employée (méthode de Seldinger ou chirurgicale) et du type de complication. Le présent travail ne nous permet pas de mettre en évidence de différence entre les deux méthodes. Cependant, la procédure de drainage chirurgicale semble plus douloureuse malgré l'utilisation d'une anesthésie locale systématique. Il est nécessaire de conduire un essai randomisé multicentrique de grande envergure afin d'identifier les conditions et indications pouvant étayer le choix d'une technique par rapport à l'autre.

Clermont-Ferrand, le 24/9/19

Pr Pierre CLAVELOU

Doyen – Directeur

The image shows a blue circular official stamp of the University of Clermont-Ferrand. The text around the stamp includes 'UNIVERSITÉ DE CLERMONT-FERRAND' and 'FACULTÉ DE MÉDECINE'. Overlaid on the stamp is a large, dark blue handwritten signature.

Clermont-Ferrand, le 16/03/19

Pr Jean-Etienne BAZIN

Le Président du Jury

Professeur J.E. BAZIN
Pôle Médecine Péri-Opératoire
C.H.U. Gabriel Montpied
58, rue Montalembert
63003 CLERMONT-FERRAND CEDEX
N° RPPS : 18003163218

TABLES AND FIGURES

TABLES

Table 1. Characteristics of patients

	Seldinger (n=105)	surgical (n=102)	<i>p</i>
Demographic parameters			
Age (years), median (IQR)	65 (54-71)	62 (51-73)	0.87
Male, n (%)	67 (66)	67 (64)	0.78
BMI, kg.m ⁻² , mean (SD)	24.6 (5.2)	24.4 (4.2)	0.75
SAPS II, mean (SD)	45 (18)	46 (18)	0.80
ICU stay, mean (SD)			
ICU los (days)	24.3 (45.5)	21.5 (45.4)	0.87
Death in ICU (days)	18 (18)	15 (14)	0.51
Post drainage MV (days)	6.5 (11.8)	6.8 (11.1)	0.79
NIV, n (%)	89 (85)	76 (75)	0.07
IMV, n (%)	16 (15)	26 (25)	

Table 2. Characteristics of drainages

	Seldinger (n=105)	surgical (n=102)	<i>p</i>
Tube Size			
	8.5F (n=3 (3))	CH 16 (n=3 (3))	
	12F (n=82 (81))	CH 20 (n=24 (24))	
	14F (n=5 (5))	CH 22 (n=2 (2))	
	16F (n=8 (8))	CH 24 (n=57 (56))	
	18F (n=1 (1))	CH 28 (n=14 (14))	
		CH 32 (n=1 (1))	
	Unknown (n=6 (6))	Unknown (n=1 (1))	
Operator characteristics			
Senior	34 (32)	34 (33)	0.88
Supervised junior	41 (39)	31 (30)	0.11
Confirmed junior	30 (29)	37 (36)	0.37
Drainage indication			
Pneumothorax	20 (19)	13 (13)	0.16
Pleural effusion	79 (75)	69 (68)	0.06
Hemothorax	3 (3)	10 (10)	0.051
Pyothorax	0	2 (2)	0.16
Hemo-pneumothorax	2 (2)	8 (8)	0.06
Pleuro-pneumothorax	1 (1)	0	0.31
Ultrasound examination			
Prior US examination	93 (89)	80 (78)	0.004*

Predicted volume (mL)	744±335	670±301	0.37
Drain insertion under US guidance	13 (13)	0	<10⁻³*
Drainage procedure			
<i>Difficulty</i>			
None	75 (71)	75 (74)	0.74
Moderate	25 (24)	22 (22)	0.54
Important	4 (4)	5 (5)	0.77
<i>Volume (mL)</i>			
After drain placement	504±460	654±1016	0.17
24 hours	865±724	982±1102	0.38
Total	1612±3385	1734±2107	0.77
<i>Fluid characteristics</i>			
Clear	54 (53)	40 (38)	0.03*
Blood	5 (5)	21 (20)	0.001*
Sero-hematic	20 (20)	29 (28)	0.18
Bilious	2 (2)	1 (1)	0.54
Pneumothorax	22 (22)	7 (7)	0.002*
Unknown	1 (1)	3 (3)	0.33
Post procedure control			
US	1 (1)	0	0.31
Radiography	35 (34)	40 (38)	0.57
CT-scan	6 (6)	3 (3)	0.29
Drain Position			
<i>Pneumothorax</i>			
Inferior	5 (5)	1 (1)	0.09
Median	6 (6)	7 (7)	0.82
Superior	9 (9)	5 (5)	0.25
<i>Pleural effusion</i>			
Inferior	42 (41)	39 (37)	0.55
Median	24 (24)	32 (30)	0.26
Superior	17 (17)	18 (17)	0.93
Drain maintenance (days)	4.8±3.0	5.1±3.4	0.54

Table 3. Drainage complications

	Seldinger (n=105)	surgical (n=102)	<i>p</i>
<i>Per-procedure</i>			
Drainage failure	6 (6)	2 (2)	0.14
Second operator	4 (4)	3 (3)	0.67
Crossover	3 (3)	0	0.08
<i>Post-procedure</i>			
Organ lesion	0	0	NA
Chest X-ray pneumothorax	2 (2)	1 (1)	0.54
Persistent bubbling	3 (3)	4 (4)	0.73
Hemothorax	0	0	NA
Parietal hemorrhage	1 (1)	1 (1)	0.98
Hematoxis alteration [‡]	3 (3)	3 (3)	0.97
Removal bleeding	1 (1)	1 (1)	0.98
Drain dislodgment [‡]	4 (4)	3 (3)	0.67
Drain blockage [€]	9 (9)	1 (1)	0.008*
<i>After drain release</i>			
Effusion production	6 (6)	0	0.01*
Volume (mL)	93±184	0	0.20
Effusion recurrence with drainage	5 (5)	8 (8)	0.42

Table 4. Characteristics and complications according to prior US examination or not

	Prior US examination	No prior US examination	<i>p</i>
Seldinger / Surgical	93 / 80	12 / 22	0.049
Day time / Night time	128 / 46	15 / 19	< 0.001
Parietal hemorrhage	4 (2%)	0	0.37
Visceral injury	0	0	NA
Empyema	0	0	NA
Malposition	34 (20%)	7 (21%)	0.09

Table 5. Characteristics of drainages conducted during day and night times

	Day time (n=143)	Night time (n=64)	<i>p</i>
Seldinger Operator	70 (49%)	35 (55%)	0.45
<i>Senior</i>	43 (30%)	25 (39%)	0.20
<i>Junior supervised</i>	49 (34%)	23 (36%)	0.82
<i>Junior</i>	51 (36%)	16 (25%)	0.13
Prior US examination	128 (90%)	45 (70%)	0.001*
Difficulty			
<i>None</i>	103 (72%)	47 (73%)	0.83
<i>Moderate</i>	33 (23%)	15 (23%)	0.96
<i>Severe</i>	7 (5%)	2 (3%)	0.56
Drainage failure	6 (4%)	2 (3%)	0.71
Second operator	6 (4%)	1 (2%)	0.33
Crossover	2 (1%)	1 (2%)	0.93
Parietal hemorrhage	4 (3%)	0	0.18
Post ponction pneumothorax	1	2	0.18
Persistent bubbling	4	3	0.49
Hemothorax	0	0	NA
Organ lesion	0	0	NA
Drain fall	5	2	0.89

Table 6. Drainage associated pains

	Seldinger (n=66)	surgical (n=63)	<i>p</i>	<i>p vs pre</i> (Seldinger)	<i>p vs pre</i> (Surgical)
<i>Pre-procedure</i>					
BPS	3.0±0.8	3.4±0.7	0.01*		
VNS	2.1±2.2	1.0±1.5	0.03*		
RASS	-1.7±2.1	-0.7±1.6	0.02*		
<i>Per-procedure</i>					
BPS	3.7±1.6	5.5±2.2	<10^{-3*}	<10^{-3*}	<10^{-3*}
VNS	4.9±2.6	5.1±3.1	0.82	<10^{-3*}	<10^{-3*}
RASS	-1.7±2.2	-0.5±1.9	0.03*	0.78	0.49
<i>Post-procedure</i>					
BPS	3.0±0.8	3.2±0.6	0.09	0.89	0.23
VNS	2.7±2.8	2.6±2.1	0.90	0.54	0.001*
RASS	-1.9±2.1	-0.7±1.6	0.02*	0.70	0.83
Need for medication change	2 (3)	10 (16)	0.01*		

Table 7. Summary of studies included in the meta-analysis

Reference	Country	Drainage indication	Mean Age (SD)	Follow up (years)	Population	Sample size (N)	Seldinger drain	Surgical drain	Design
Collop 1997 (35)	USA	Pneumothorax Malignant effusion Pleural infection Others	51 (2) years	2	ICU And Medicine	91	11	105	Multicenter Prospective
Clements 1998 (36)	Denmark	Malignant effusion	65 (3.6) (S) 70.4 (3.5) (L) years	Not reported	Pulmonary Medicine	18	9	9	Single-centre Randomized
Parelukar 2001 (37)	Canada	Malignant effusion	65 years	9	Medicine	102	58	44	Single-centre Retrospective
Vedam 2003 (38)	Australia	Spontaneous Pneumothorax	37 (S) 36 (L) years	3	Not reported	67	31	36	Single-centre Retrospective
De Waele 2003 (39)	Belgium	Pleural effusion	53 (19) years	1	ICU	58	45	29	Single-centre Retrospective
Tsai 2006 (40)	Taiwan	Secondary spontaneous Pneumothorax	60 (19) years	3	ED and Medicine	91	69	22	Single-centre Retrospective
Cagaylan 2008 (41)	Turkey	Malignant effusion	55 (15) years	3	Medicine	43	23	20	Single-centre Randomized
Rivera 2009 (42)	USA	Pneumothorax Hemothorax Pleural effusion Empyema Others	49.8 (S) 40.6 (L) years	4	ICU and ED	202	131	71	Single-centre Retrospective
Rahman 2010 (43)	UK	Pleural infection	60 (18) years	Not reported	Medicine	454	265	140	Multicenter Prospective
Kulvatunyo u 2011 (8)	USA	Pneumothorax Hemothorax Pleural effusion	43 (21) (S) 40 (18) (L) years	2	ICU and ED	480	94	386	Single-centre Retrospective
Kulvatunyo u 2012 (9)	USA	Hemothorax Hemopneumothorax Traumatic	53 (4) (S) 41 (1.4) (L) years	2	ICU and ED	227	36	191	Single-centre Prospective
Kulvatunyo u 2013 (7)	USA	Pneumothorax Traumatic	46 (4) years	2	ED	40	20	20	Single-centre Randomized
Contou 2012 (44)	France	Pneumothorax (All causes)	38 (19) (S) 42 (21) (L) years	8	ICU	212	112	100	Single-centre Retrospective
Bauman 2018 (11)	USA	Hemothorax (Emergent and non-emergent)	52 (21) (S) 42 (19) (L) years	7	ICU and ED	496	189	307	Single-centre Prospective

FIGURES

Figure 1. Drainages complications

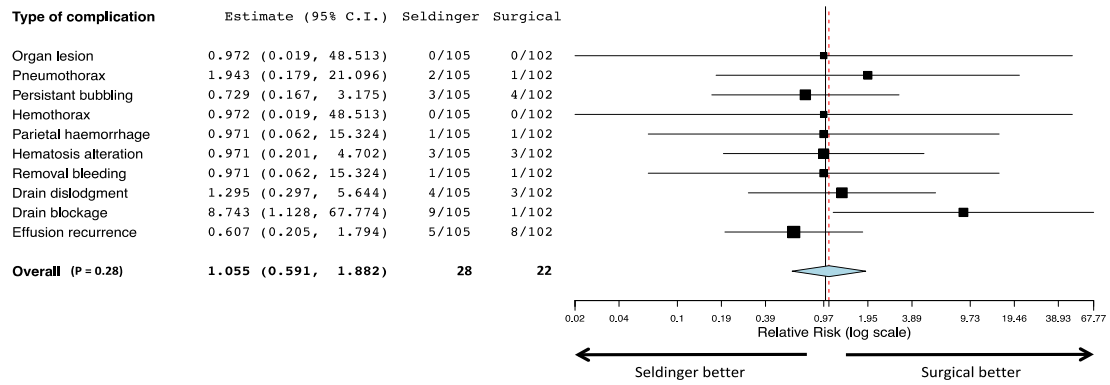


Figure 2. Flow diagram of meta-analysis

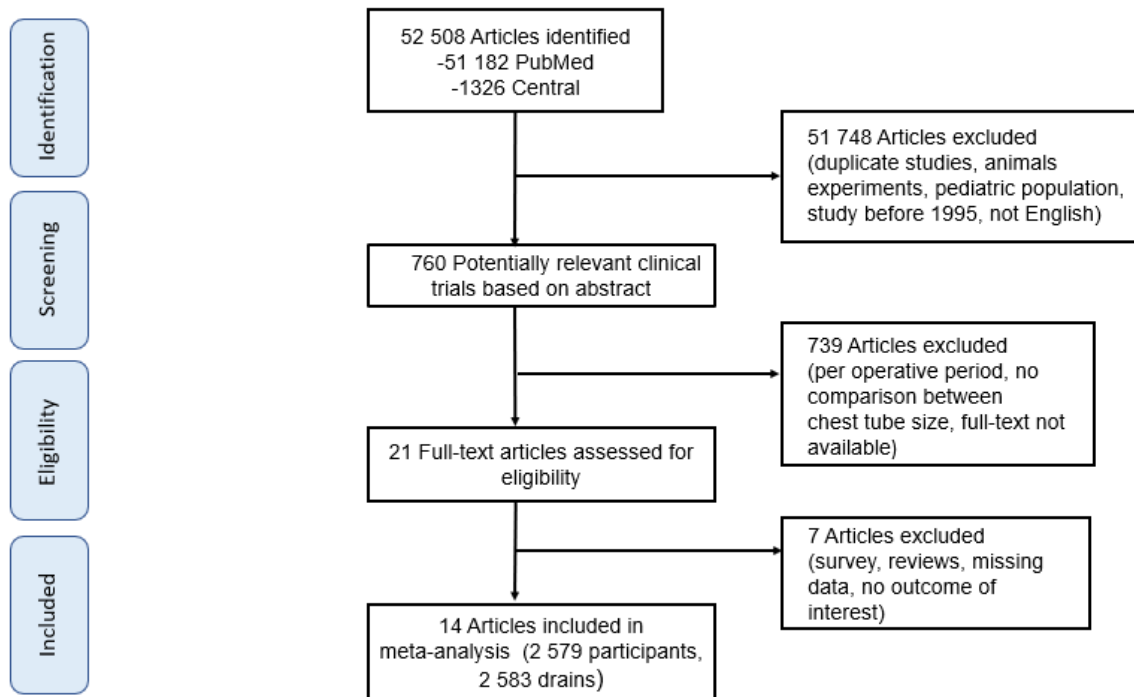


Figure 3. Forest plot for the risk of complications according to Seldinger and surgical methods

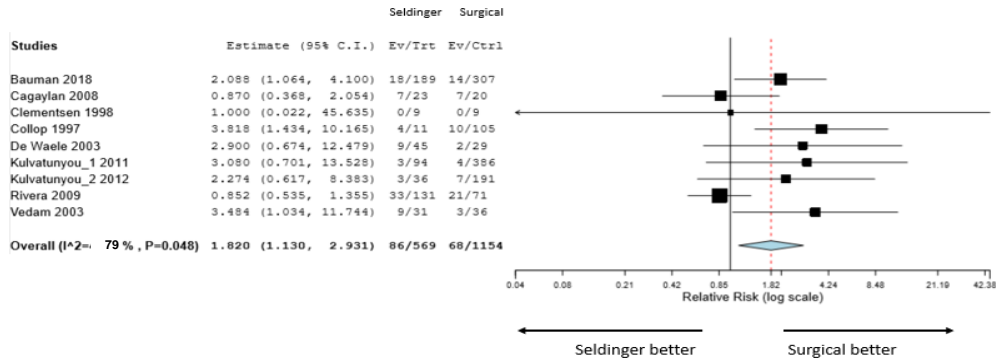


Figure 4. Forest plot for the risk of major bleeding according to Seldinger and surgical methods

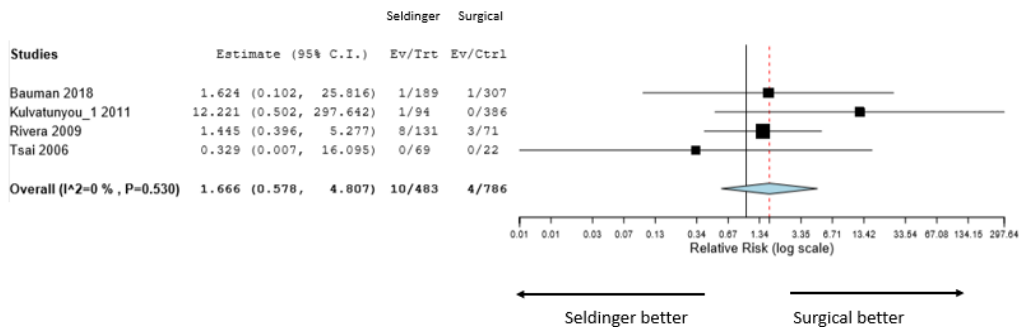


Figure 5. Forest plot for the risk of organ injury according to Seldinger and surgical methods

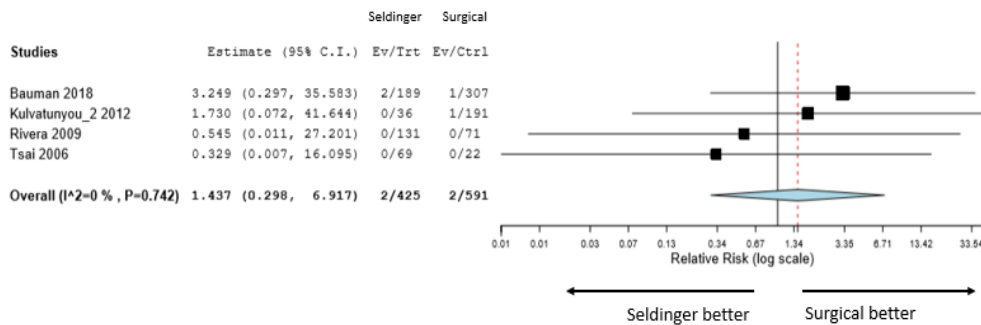


Figure 6. Forest plot for the risk of empyema according to Seldinger and surgical methods

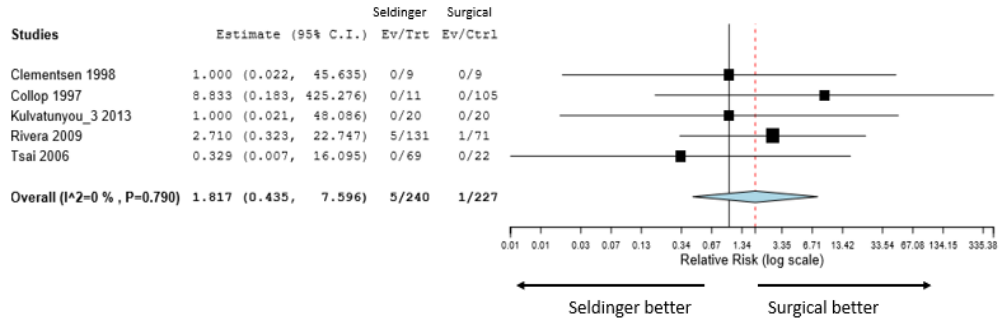


Figure 7. Forest plot for the risk of malposition according to Seldinger and surgical methods

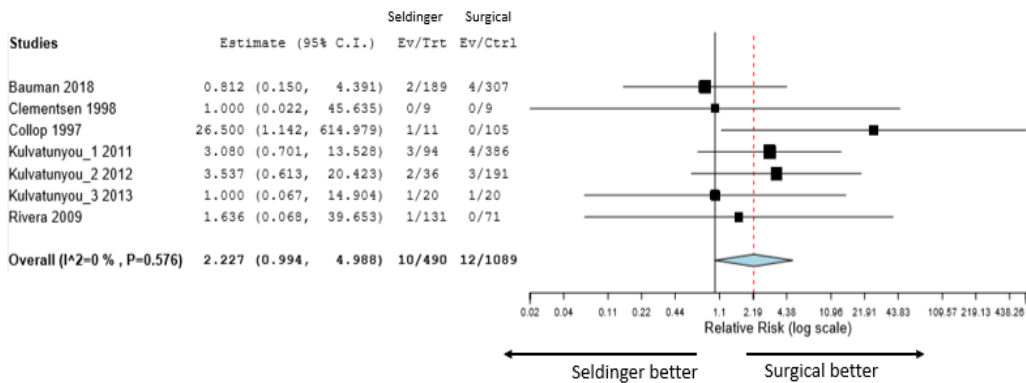


Figure 8. Forest plot for the risk of dislodgement according to Seldinger and surgical methods

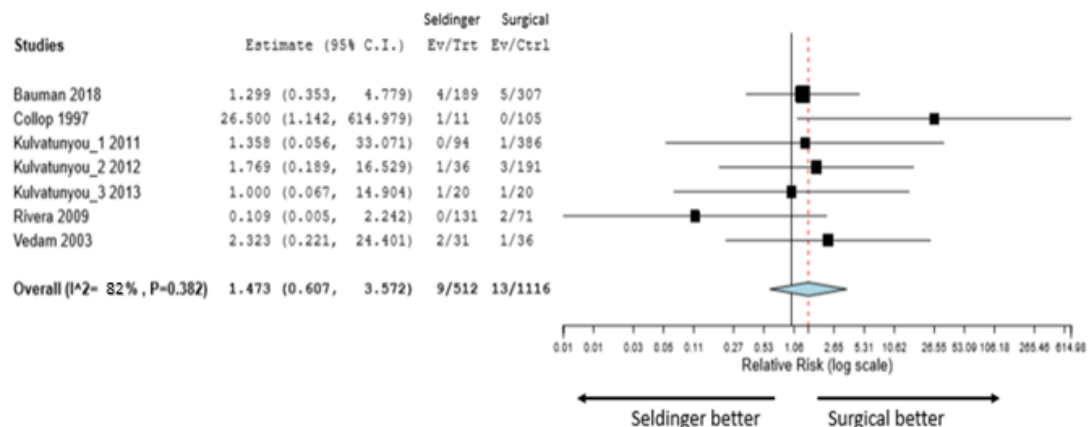


Figure 9. Forest plot for the risk of drainage failure according to Seldinger and surgical methods

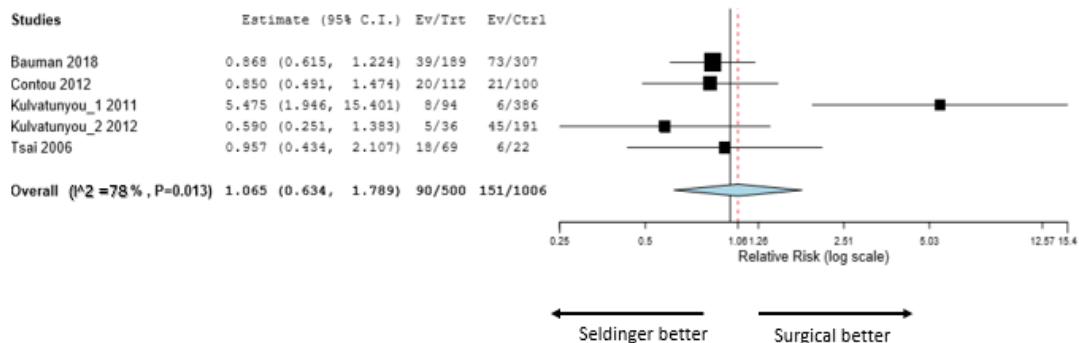


Figure 10. Forest plot for the risk of pneumothorax according to Seldinger and surgical methods

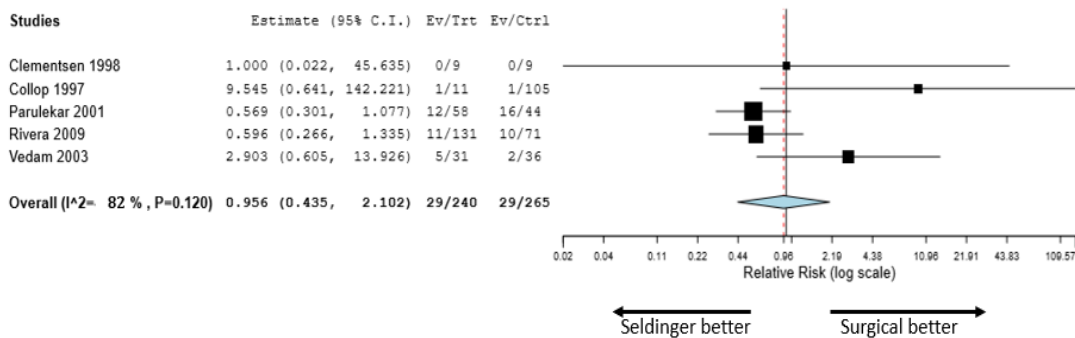


Figure 11. Forest plot for the risk of blockage according to Seldinger and surgical methods

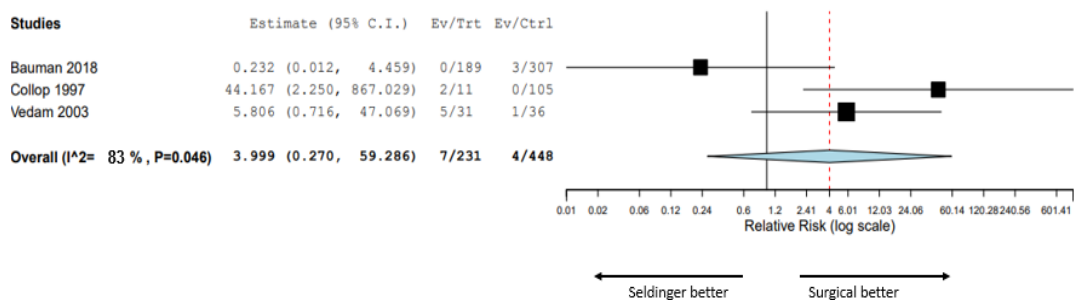
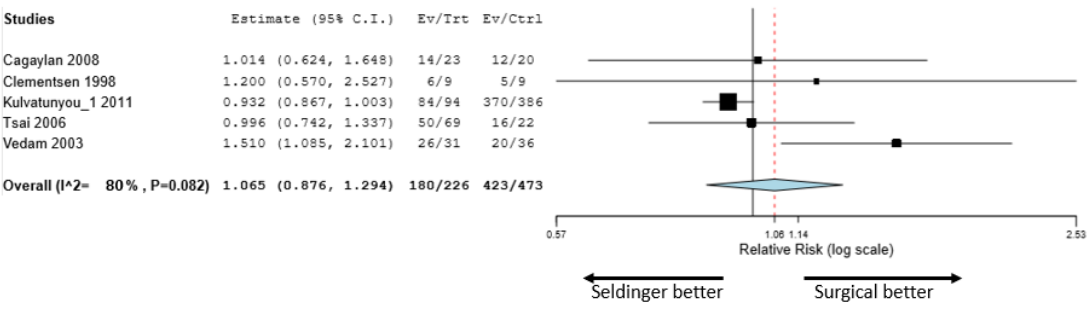


Figure 12. Forest plot for the risk of success according to Seldinger and surgical methods



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APPENDIX

Table 1. Evaluations of RCTs according to Cochrane Collaboration method for assessing risk of bias.

	Selection bias		Performance bias	Detection bias	Attrition bias	Reporting bias	Other bias
	Random sequence generation	Allocation concealment	Blinding of participants and personnel	Blinding of outcome assessment	Incomplete outcome data	Selective reporting	Other sources of bias
Clements 1998	?	?	-	+	+	-	?
Cagaylan 2008	?	-	-	-	+	?	?
Kulvatunyou 2013	+	+	?	+	+	-	?

Table 2. Evaluations of observational studies according to GRACE and STROBE checklists.

STUDIES		Collop	Parekular	Vedam	De Waele	Tsai	Rivera	Rahman	Kulvatunyou	Kulvatunyou	Contou	Bauman
		1997	2001	2003	2003	2006	2009	2010	2011	2012	2012	2018
GRACE	D1	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	D2	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	D3	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	D4	No	Yes	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
	D5	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	D6	No	Yes	No	Yes	No	No	Yes	Yes	No	Yes	No
	M1	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	M2	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
	M3	No	Yes	No	Yes	No	No	No	No	No	Yes	No
	M4	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	M5	No	No	No	No	No	No	No	No	No	No	No
STROBE	1a	1	1	1	1	1	1	1	1	1	1	1
	1b	1	1	1	1	1	1	1	1	1	1	1
	2	1	1	1	1	1	1	1	1	1	1	1
	3	0	1	1	0	1	1	1	1	1	1	1
	4	1	1	1	1	1	1	1	1	1	1	1
	5	1	1	0	1	1	1	0	1	1	1	1
	6a	0	1	1	1	1	1	1	1	1	1	1
	6b	0	0	0	0	0	0	0	0	0	0	0
	7	0	1	0	1	0	0	1	0	0	1	0
	8	0	1	1	1	0	1	1	0	1	1	1
	9	0	1	0	1	0	0	1	0	0	1	0
	10	0	0	0	0	0	0	0	0	0	0	0
	11	0	1	1	1	1	1	1	1	1	1	1
	12a	0	1	0	1	0	0	1	0	0	1	0
	12b	0	0	0	1	0	1	1	0	0	1	1
	12c	0	1	0	0	0	0	0	0	0	0	0
	12d	0	0	0	0	0	0	1	0	0	0	0
	12e	0	0	0	0	0	0	0	0	0	1	0
	13a	1	1	0	1	1	1	1	0	1	1	1
	13b	0	1	0	1	1	1	0	0	0	1	0
	13c	0	0	0	0	1	1	0	0	0	1	0
	14a	1	1	0	1	1	0	1	1	1	1	1
14b	0	0	0	0	0	0	0	0	0	0	0	
14c	0	0	0	0	0	1	0	0	0	1	0	
15	1	1	1	1	1	1	1	1	1	1	1	
16a	0	0	0	0	0	0	0	0	0	1	0	
16b	1	1	1	1	1	1	1	1	1	1	1	
16c	0	0	0	0	0	0	0	0	0	0	0	
17	1	1	0	1	0	1	1	0	1	1	1	
18	1	1	1	1	1	1	1	1	1	1	1	
19	0	1	1	1	1	1	0	1	1	1	1	
20	1	1	1	1	1	1	1	1	1	1	1	
21	1	1	1	1	1	1	1	1	1	1	1	
22	0	0	0	0	0	0	0	1	0	0	0	

SERMENT D'HIPPOCRATE

Au moment d'être admis(e) à exercer la médecine, je promets et je jure d'être fidèle aux lois de l'honneur et de la probité.

Mon premier souci sera de rétablir, de préserver ou de promouvoir la santé dans tous ses éléments, physiques et mentaux, individuels et sociaux.

Je respecterai toutes les personnes, leur autonomie et leur volonté, sans aucune discrimination selon leur état ou leurs convictions. J'interviendrai pour les protéger si elles sont affaiblies, vulnérables ou menacées dans leur intégrité ou leur dignité. Même sous la contrainte, je ne ferai pas usage de mes connaissances contre les lois de l'humanité.

J'informerai les patients des décisions envisagées, de leurs raisons et de leurs conséquences. Je ne tromperai jamais leur confiance et n'exploiterai pas le pouvoir hérité des circonstances pour forcer les consciences.

Je donnerai mes soins à l'indigent et à quiconque me les demandera. Je ne me laisserai pas influencer par la soif du gain ou la recherche de la gloire.

Admis(e) dans l'intimité des personnes, je tairai les secrets qui me seront confiés. Reçu(e) à l'intérieur des maisons, je respecterai les secrets des foyers et ma conduite ne servira pas à corrompre les mœurs. Je ferai tout pour soulager les souffrances. Je ne prolongerai pas abusivement les agonies. Je ne provoquerai jamais la mort délibérément.

Je préserverai l'indépendance nécessaire à l'accomplissement de ma mission. Je n'entreprendrai rien qui dépasse mes compétences. Je les entretiendrai et les perfectionnerai pour assurer au mieux les services qui me seront demandés.

J'apporterai mon aide à mes confrères ainsi qu'à leurs familles dans l'adversité.

Que les hommes et mes confrères m'accordent leur estime si je suis fidèle à mes promesses; que je sois déshonoré(e) et méprisé(e) si j'y manque.

SERMENT D'HIPPOCRATE

En présence des Maîtres de cette FACULTE et de mes chers CONDISEIPLES, je promets et je jure d'être fidèle aux lois de l'Honneur et de la Probité dans l'exercice de la Médecine.

Je donnerai mes soins gratuits à l'indigent et je n'exigerai jamais un salaire au-dessus de mon travail. Admis dans l'intérieur des maisons, mes yeux ne verront pas ce qui s'y passe, ma langue taira les secrets qui me seront confiés et mon état ne servira pas à corrompre les mœurs ni à favoriser le crime.

Respectueux et reconnaissant envers mes MAÎTRES, je rendrai à leurs enfants l'instruction que j'ai reçue de leurs pères.

Que les HOMMES m'accordent leur estime si je suis fidèle à mes promesses. Que je sois couvert d'OPPROBRE et méprisé de mes confrères si j'y manque.

Drains thoraciques en Réanimation. Comparaison des méthodes Seldinger et chirurgicale. /tude rétrospective multicentrique.

Introduction : La procédure de drainage thoracique est fréquente en unité de soins critiques (Réanimation ou Unité de Soins Continus), et associée à un taux de complications faible mais de sévérité variable. Les recommandations britanniques publiées en 2010 encouragent l'utilisation de petits drains insérés par la méthode de Seldinger par rapport aux larges drains chirurgicaux. Cependant, ces recommandations reposent sur des études de faibles niveaux de preuve . En vue de réaliser une étude multicentrique randomisée de grande envergure, nous avons recherché les taux de complications de chaque technique.

Matériels et Méthodes : Nous avons analysé de manière rétrospective les dossiers informatisés de patients consécutifs ayant bénéficié d'un drainage pleural quelle qu'en soit l'indication, dans 5 unités de soins critiques de 5 CHU français. Les données démographiques, les antécédents notables, les caractéristiques du drainage (type de drain, indications, utilisation de l'échographie, douleurs...) étaient colligées. Les complications majeures (lésions d'organe, pneumothorax, hémothorax, empyème) et mineures dont les complications liées à l'insertion (taux d'échec, difficulté de pose, nécessité d'un second opérateur, cross over, malposition, blocage, déconnexion) étaient relevées. Des analyses uni et multivariées ont été réalisées afin de comparer les complications associées à chaque technique. Nous avons également conduit une revue systématique de la littérature et une méta-analyse des complications rapportées dans chaque groupe.

Résultats : Entre janvier et septembre 2018, 207 patients ont bénéficié d'un drainage pleural : 105 selon la méthode de Seldinger (S) et 102 de manière chirurgicale (C). Les indications étaient comparables. L'évaluation échographique préalable était préférentiellement réalisée dans le groupe (S) (89% versus 79%, $p=0,004$). Un drainage échoguidé était effectué chez 13 patients ((13%) du groupe (S) versus 0 dans le groupe (C), $p<10^3$). Le taux de complications étaient similaires entre les deux groupes hormis le taux d'obstruction (9 (9%) versus 0, $p=0,008$). Parmi ces patients, un épanchement résiduel post-drainage était retrouvé chez 6 patients (6%) du groupe (S) versus 0 ($p=0,01$). La nécessité d'un second drainage était faible : 5 (5%) versus 8 (8%) ($p=0,42$). La douleur procédurale était plus importante lors des drainages chirurgicaux (BPS= $3,7\pm 1,6$ (S) versus $5,5\pm 2,2$ (C), $p<10^3$) malgré une anesthésie locale systématique. Les résultats de la méta-analyse, surtout basée sur des études de faible qualité méthodologique, tend à conclure à une équivalence des incidences des complications entre les deux groupes.

Conclusion : Les taux de complications liées au drainage pleural de patients de soins critiques retrouvés sont compris entre 0 et 9%, en accord avec la littérature, et dépendent de la technique employée (méthode de Seldinger ou chirurgicale) et du type de complication. Le présent travail ne nous permet pas de mettre en évidence de différence entre les deux méthodes. Cependant, la procédure de drainage chirurgical semble plus douloureuse malgré l'utilisation d'une anesthésie locale de manière systématique. Il est nécessaire de conduire un essai randomisé multicentrique de grande envergure afin d'identifier les conditions et indications pouvant étayer le choix d'une technique par rapport à l'autre.

Mots-clés : Drainage thoracique, méthode Seldinger, méthode chirurgicale, complications, réanimation

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