Perspectives of using of "aseptic" drains for abdominal drainage

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AIM: *Aim of the study was to evaluate the effectiveness of using different types of drain tubes to prevent and reduce the drain-associated infection rate of abdominal drainage procedures.*
MATERIALS AND METHODS: *80 cases of used so called "standard", "coladerm" and "chlorhexidine" drain tubes for abdominal drainage were analysed. "Standard" drain tubes were used 35 times and "coladerm" and "chlorhexidine" tubes – 20 and 25 times respectively. There were adopted in different elective and emergency so called "clean", "potentially contaminated" and "contaminated" abdominal surgical procedures. The drain tubes were removed between 2 to 14 days after the operations followed by the bacteriological study in search of bacteria growth on the surface of drainage tubes were examined.*
RESULTS: *Of all 35 cases of used "standard" drain tubes the bacterial growth was found in 23 cases, that means 65,7%; of 20 cases of drains covered by "coladerm" polymer the bacterial growth was found in 6 cases (30%) and only in 3 cases of 25 cases of drain tubes covered by polymer and "chlorhexidine" were positive, that means 12%. The most interesting data were obtained considering the so called "clean" and "contaminated" operations. After the so called "clean" operations the bacterial growth using "standard" drain tubes was found almost in 50% of cases and in 8,3% of cases using "chlorhexidine" drain tubes. After the "potentially contaminated" and "contaminated" operations the bacterial growth was found in 68,2% using "standard" tubes, and using "coladerm" and "chlorhexidine" drain tubes – in 50% and 16,7% respectively.*
CONCLUSIONS: *In our limited experience using of new antimicrobial polymeric composites as coatings mean the adhesion of bacteria and formation of biofilm at drainage tubes is prevented, which can significantly reduce the drain-associated infection rate.*

KEY WORDS: Abdominal drainage, Bacterial growth, Infection rate

Introduction

There is no doubt, that history of abdominal drainage is as old as the history of surgery [1]. However, the abdominal drainage was always been the subject of controversy, discussions and investigation among active supporters and opponents of the surgical community around the world. Still today, after the hundred years passed, during which the operative surgery, technique, new technologies and operative procedures have been progressed and revolutionarily developed, drainage and associated effects is a controversial issue still at the present time. As figuratively stated by Schein (2008), the question is: To drain or not to drain? It seems that this question will be more complete in the following version: When

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and which drains must be used for abdominal drainage procedures?

Starting from Hippocrates and Celsus surgeons around the world for centuries are using the drains after different surgical procedures. In 1887 Tait advocated his famous aphorism: "When in doubt, drain", which is still very popular today and well known to most of surgeons[2]. Hence, Halsted even in 1898 wrote his notification that "no drainage at all is better than ignorant employment of it", there were also the skeptics, like Yates (1905), who understood that "Drainage of the general peritoneal cavity is a physical and physiological impossibility"[3].

Thus, the main issues of using the drains are the follows: When using the drains? Time interval of drainage? Which are the "best" drains?

In regard to the first question the group of authors have summarized the indications and reasons for the drainage and have concluded that generally the drainage is used for the two main reasons: therapeutic and prophylactic, and the various types of drain tubes are used as "active" and "passive" [1-4]. At this point it must be noted that despite of different approaches of using of drains in abdominal surgery, nowadays indications for prophylactic drainage are more and more diminishing, especially in elective surgical procedures. Concerning the second question, the consensus among the surgeons is more rather uniform as most of them agreed that the drains should be removed as soon as possible at the earliest time after the operation[5,6].

Therefore, in this study we have attempted to answer the third question.

Materials and Methods

We have studied and analysed the results of using the three types of drain tubes for abdominal drainage during 80 different 80 surgical procedures performed in the period between 09.03.11 to 06.12.11. The drain tubes were divided as follows: "standard", "coladerm" and "chlorhexidine" drain tubes. All these tubes were polyvinylchloride (PVC) round drain tubes with multiple holes. There were performed at the end of the following different elective and emergency surgical interventions which are listed in Table I, and the drain tubes for abdominal drainage were used as follows: "standard" drain tubes – 35 times, "coladerm" – 20 and "chlorhexidine" tubes – 25 times.

We were using in our study the new Polyesteramide biodegradable polymer 7% solution ("Coladerm" – registration certificate N003999 of Ministry of Health of Georgia) and chlorhexidine as antiseptic and disinfection agent to cover the drain tubes, which were than using for abdominal drainage. The drains were removed from 2 to 14 days after the operations and the bacteriological study of bacterial growth on the surface of drain tubes were examined during our investigations.

TABLE I - *Surgical procedures*

Types	Number
Appendectomy	17
Cholecystectomy	15
Splenectomy	10
Adhesiolysis	8
Hysterectomy	5
Fundoplication	4
Debridement of Pancreatic Necrotic Tissue	4
Drainage of Abdominal Cavity Abscesses	3
Duodenal ulcer rrhaphy	2
Coloplasty	2
Hemicolectomy	2
Partial gastrectomy	2
Abdominoperineal resection	2
Hepaticojejunostomy	2
Resection of small intestine	1
Echinococcectomy	1
Total	**80**

Results

The obtained results were as follows: of all 35 cases with the use of "standard" drain tubes the bacterial growth was found in 23 cases, which is 65,7%; in 20 cases of drains covered by polymer "coladerm" (which has slightly associated bactericidal effect) the bacterial growth was found in 6 cases (30%), and in 25 cases of drain tubes covered by polymer and "chlorhexidine" only 3 cases resulted positive, which is 12%.

The most interesting data were obtained of so called "clean" and "contaminated" operations. After the so called "clean" operations the bacterial growth of using "standard" drain tubes was found almost in 50% of cases and in 8,3% in cases of "chlorhexidine" drain tubes. After the "potentially contaminated" and "contaminated" operations the bacterial growth was found in 68,2% using "standard" tubes, and using "coladerm" and "chlorhexidine" drain tubes – in 50% and 16,7% respectively.

There were found different types and concentration (from 10^3 to 10^6) of bacterial flora during bacterial study of removed drain tubes: Escherichia coli, Enterococcus faecalis, Staphylococcus epidermidis, Candida albicans, Enterobacter cloachae.

Discussion

Despite the progress and achievements of operative surgery, intensive and postoperative care, the use of abdominal drainages is still a subject of controversy. Many published randomized controlled trials have questioned the routine use of abdominal drains, but many

surgeons for safety are continuing to use them in their practice. More then five million drains are used each year only in the USA and this concept is still very popular also among the East European and Former Soviet Republic countries surgeons[10-17]. However the use of drains can be associated with serious complications, such as: drain tract infection, bleeding, hernia, intestinal obstruction, bowel's and vessel's erosion, occlusion, kinking and knotting of drains, "lost" drains and failure to retrieve and etc [1,3,7-9].

It is generally known, that drain tubes, intravascular catheters, ureteral splints and other surgical prostheses are susceptible to bacterial colonization and contamination. There are many published reports in literature referring infection rate of drainage tubes[18-21]. D.Adam and L.Pfafferot (1977) reported the highest 70% contamination rate of wound drains after abdominal operations and other authors have reported the infection rate from 10% to 37,5% of drainage procedures[18-24].

As mentioned by M. Schein (2010) "your open passive drain would serve mostly as one-way autobahn for skin bacteria". Our data also confirm the fact, that usage of abdominal drains is potential risk and source of contamination and infection even at so called "clean" surgical procedures. Therefore the development of new technologies to make the medical devices and drains resistant to microorganisms colonization and to prevent devices from biofilm formation remains a as topical issue at the present time.

In our study we were using new bactericidal polymeric composite materials on the basis of biodegradable polyesteramide ("coladerm") matrix. The polymeric matrix was impregnated with the antiseptic and disinfect agent "chlorhexidine" and the erosive biodegradation of this matrix at a constant rate provide a sustained/controlled release of impregnated bactericides in surroundings tissues. This kill the microorganisms in more sensitive planktonic state, that should prevent the formation of biofilm at the surface of the composite polymeric. Thus, bio-erodible antimicrobial coatings of used abdominal drain tubes were as "discomfort shelter" for bacteria, which were confirmed by study of bacterial growth over them.

So we have attempted to use so called "aseptic" drains to prevent and minimizing the drain-associated infection rate when using drain tubes covered by "chlorhexidine", which is well known as high-grade antiseptic and disinfect agent. The abdominal drain-associated infection rate was decreased in our study from 65.7% to 12%, which is in our opinion a very encouraging progress.

Conclusion

Based on our preliminary results, we can suggest, that using of new antimicrobial polymeric composites as coatings prevent the adhesion of bacteria and formation of biofilm in surgical devices like catheters and drain tubes, which can significantly reduce the drain-associated and therefore Hospital acquired infection rate. Of course, it is not a complete solution of this problem as future investigations and detailed data are necessary, but the preliminary results of decreasing the infection rate during using abdominal drainage seems to be very promising. As rightly have mentioned by M. Schein (2010) "such complication can be prevented by correct placement and management of drain tubes or, better, avoiding drains when not indicated".

Riassunto

Lo scopo di questo studio, effettuato su 80 casi di drenaggi addominali, usando tubi "standard", tipo "coladerm" e tipo "clorexidina", è stato quello di valutare l'efficacia dell'uso di differenti tipi di tubi di drenaggio nel prevenire e ridurre l'incidenza delle infezioni associate ai drenaggi addominali.

I tubi di drenaggio "Standard" sono stati usati in 35 casi, mentre quelli "coladerm" e "chlorhexidine" rispettivamente 20 e 25 volte. Questi drenaggi addominali sono stati adottati complessivamente in caso di procedure chirurgiche elettive e di urgenza di tipo "pulito", ma anche "potenzialmente contaminate" e francamente "contaminate".

I drenaggi sono stati rimossi da 2 a 14 giorni dopo l'intervento e sottoposti a controllo batteriologico alla ricerca di crescita batterica.

In tutti i 35 casi in cui sono stati usati tubi di drenaggio "standard" la crescita batterica è stata trovata 23 volte, pari al 65,7%. Nei 20 casi di tubi ricoperti da polimero "coladerm" la crescita batterica è stata riscontrata in 6 casi (pari la 30%), e soltanto in 3 casi sui 25 drenaggi ricoperti dal polimero "crorexidina", (pari al 12%).

Il dato più interessante riguarda il confronto tra i casi di chirurgia "pulita" e quelli di chirurgia "contaminata: dopo le operazioni "pulite" l'accrescimento batterico su tubi standard è stata riscontrata in almeno il 50% dei casi, mentre nel 8,3% con l'uso dei tubi a "clorexidina". Dopo interventi potenzialmente contaminati o francamente contaminati la crescita batterica è stata riscontrata nel 68,2% dei casi sui tubi "standard", mentre sui tubi rivestiti con "coladerm" o con "clorexidina" rispettivamente nel 50% e nel 16,7%.

Pur con questa limitata esperienza usando queste nuove composizioni polimeriche antimicrobiche a rivestimento, l'adesione batterica e la formazione di biofilm sui tubi di drenaggio risulta contrastata, con significativa riduzione dell'incidenza delle infezioni associate alle procedure di drenaggio.

References

1. Schein M, Rogers P: *Abdominal Drainage*. In: *Schein's Common Sense Emergency Abdominal Surgery.* Heidelberg: Springer-Verlag, 2010; 455-66.

2. Cerise E, Pierce W, Diamond D: *Abdominal Drains: Their role as a source of infection following splenectomy.* Ann Surg, 1970; 171(5):764-69.

3. Loh A, Jones P: *Evisceration and other complications of abdominal drains.* Postgrad Med J, 1991; 67:687-88.

4. Schein M: To *Drain or not to Drain? The Role of drainage in the contaminated and infected abdomen: An international and personal perspective.* World J Surg, 2008; 32:312-21.

5. O·Connor T, Hugh T: *Abdominal drainage: A clinical review.* Aust N Z J Surg, 1979; 49(2):253-60.

6. Adam D, Pfafferott L: *Bacteriological investigation of drains and catheters in pediatric surgery (authors transl).* Munch Med Wochenschr, 1977; 119(32-33):1039-42.

7. Ravishankar HR, Malik RA, Burnett H, Carlson GL: *Migration of abdominal drains into the gastrointestinal tract may prevent spontaneous closure of enterocutaneous fistulas.* Ann R Coll Surg Engl, 2001; 83:337-38.

8. Nomura T, Shirai Y, Okamoto H, Hatakeyama K: *Bowel perforation caused by silicone drains: areport of two cases.* Surg Today, 1998; 28(9):940-2.

9. Carlomagno N, Santangelo M, Grassia S et al.: *Intraluminal migration of a surgical drain. Report of a very rare complication and literature review.* Ann Ital Chir, 2013; 84:219-23.

10. Petrowsky H, Demartines N, Rousson V, Clavien PA: *Evidence-based value of prophylactic drainage in gastrointestinal surgery: A systemic review and meta-analyses.* Ann Surg, 2004; 240(6):1074-84.

11. Imparato M, Simoneti M, Viti M,et al.: *The rational use of drains in surgery.* Minerva Chir, 1993; 48(18):1011-14.

12. Ziubrytskyi MM, Slabinskyi VV, Stryshka RI, Onufran SM: *Drainage in surgery: History,theory,drainage procedures.* Klin Khir, 2011; 4:35-37.

13. Sequens R: *Initial experience with a new silicone drain made by Rubena Nachod.* Rozhl Chir, 1993; 72(6):281-83.

14. Serclova Z, Antos F: *Drainage of the abdominal cavity using a simple and reliable system.* Rozhl Chir, 1999; 78(11):587-89.

15. Swartz AL, Azuh O, Obeid LV et al.: *Developing an experimental model for surgical drainage investigations: An initial report.* Am J Surg, 2012; 203(3):388-91.

16. Launay-Savary MV, Slim K: *Evidence-based analysis of prophylactic abdominal drainage.* Ann Chir, 2006; 131(5):302-5.

17. Memon MA, Memon B, Memon MI, Donohue JH: *The uses and abuses of drains in abdominal surgery.* Hosp Med, 2002; 63(5):282-88.

18. Chisena S, Marconato R, Cantoni G et al.: *Importance of Staphylococcus epidermidis in the bacterial colonization of abdominal drains in surgical patients.* Minerva Chir, 1991; 46(6):269-72.

19. Salgado W Jr, Cunha Fde Q, dos Santos JS et al.: *Routine abdominal drains after Roux-en-Y gastric bypass: A prospective evaluation of the inflammatory response.* Surg Obes Relat Dis, 2010; 6(6):648-52.

20. Michalska W, Chylak J, Marciniak R et al.: *Analysis of aerobic and anaerobic bacterial flora colonizing drains after surgical abdominal incisions.* Med Dosw Mikrobiol, 1997; 49(1-2):75-81.

21. Guo W, Andersson R, Odselius R et al.: *Phospholipid impregnation of abdominal rubber drains: Resistance to bacterial adherence but no effect on drain-induced bacterial translocation.* Res Exp Med(Berl), 1993; 193(5):285-96.

22. Dasic D, Hanna SJ, Bojanic S, Kerr RS: *External ventricular drain infection: The effect of a strict protocol on infection rates and a reviw of the literature.* Br J Neurosurg, 2006; 20(5):296-300.

23. Camacho EF, Boszczowski I, Basso M et al.: *Infection rate and risk factors associated with infections related to external ventricular drain.* Infection, 2011; 39(1):47-51.

24. Higson RH, Kettlewell MG: *Parietal wound drainage in abdominal surgery.* Br J Surg, 1978; 65(5):326-29.