

## A CRITICAL ANALYSIS OF PREVENTION OF SURGICAL SITE INFECTION BY DISINFECTION WITH SPECIAL REFERENCE TO DHOOPAN (MEDICATED FUME)

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### ABSTRACT

The word “disinfection” means destruction of all pathogenic organisms capable of causing infection. In modern science, all the invasive procedures involve contact by a medical device or surgical instruments with a patient sterile tissue or mucous membrane. In surgical aspect, disinfection is vital and primary preoperative step to avoid the surgical site infection. During the 1850s Florence Nightingale was a pioneer and reformer of hospital sanitations method although she was unaware that bacteria are cause of infections. In the late 1860s Lister introduced the concept of asepsis into the practice of surgery and started to disinfect skin, suture material and wounds leading to a reduction in

mortality after amputations. In *Ayurveda*, the importance of maintaining the aseptic conditions is well explained in different compendiums like *Kashyapsamhita* and *Sushrutasamhita*. *Sushruta* stated flaming of instruments to be used for surgery preoperatively. He also included *Dhoopan* means exposing post-operative wound to medicated fumes of drugs containing analgesic and antibacterial properties. He has also mentioned the isolation of patient after operative procedure in the special chamber which should be previously fumigated and also described the daily fumigation of this chamber to protect the surgical site infection. This article is written to explore all the methods of disinfection mentioned in *Samhita* period and their relevance in today's era. For this purpose all classical and modern literature and journals are searched regarding methods of disinfection to prevent surgical site infection. At the end we can say that *Sushruta* is the pioneer of concept of disinfection. Various methods of disinfection to prevent the surgical site infection are developed on the base of ancient concept of disinfection.

**KEYWORDS:** Vranitagara, Dhoopan, Azadirachta indica, Comminiphora mukul, Brassica nigra, Flaming, fumigation.

## INTRODUCTION

The word “disinfection” means destruction of all pathogenic organisms capable of causing infection. Sterilization kills organism including spores. There are different methods of disinfection which can be broadly divided into physical and chemical methods. Physical method includes burning/ incineration and boiling. Boiling kills bacteria but not spores hence it is replaced by autoclave in which steam under pressure is used to kill all organisms including spores. Radiation is also one of the methods of sterilization which is divided in two types ionizing and non- ionizing. Ionizing radiation includes atomic gamma radiation and non- ionizing radiation is either infra- red or ultraviolet radiations use to reduce bacteria in air and water. Whereas chemical methods include disinfection or sterilization with chemical agents like phenol, cresol, lysol, chlorhexidine, hexachlorophene, cetrimide etc.<sup>[1]</sup>

## Surgical infection

Surgical infection is the commonest health problem in surgical procedures, it can occur at any step of procedure including preoperative preparations. Patients with immunocompromised diseases are more prone for such infections. It can also occur due to ignorance towards basic aseptic conditions. In modern context, there are different criteria for calculating the surgical site infection.

In *Ayurveda*, vast description regarding disinfection is available in different compendiums like *Kashyapsamhita*, *Sushrutasamhita* etc. *Sushruta* includes *Dhoopan* means exposing wound to medicated fumes of drugs which act as both analgesic and antibacterial properties. In post- operative management *Sushruta* has also indicated the isolation of the patient in special chamber which is already fumigated to prevent the infection in post-operative wound

## Review of literature

Disinfection means killing of all bacteria, fungi, and viruses but not spores whereas sterilization also kills the spores.<sup>[2]</sup>

## Different types of disinfection/sterilization

### Physical agents

1. Burning or incineration: it is used to disinfect articles like dressing.

2. Hot air oven: temperature used is 160 to 180 degree Celsius for one hour.
3. Boiling: temperature is between 90- 99 degree Celsius. It is used to disinfect syringes, utensils, but not useful for gloves or rubber materials.
4. Autoclave: temperature is between 120-135 degree Celsius. It is sterilized for 20 minutes with 15 pounds/ square inch pressure.

### **Radiation**

1. Ionizing radiation: it includes atomic gamma radiation commercially used for sterilization of suture material, disposable materials in packets.
2. Non ionizing radiation: either infra- red or UV radiation is used for sterilization

### **Chemical agents**

1. Halogens: includes EUSOL (Edinburg university solution) which contains sodium hypochlorite, boric acid, and calcium hydroxide used in ulcer as eusol bath 30 minutes 2-3 times a day.
2. Formaldehyde: 500 ml of formalin with one litre of water is boiled to get formaldehyde vapours used to disinfect the operation theatre

**Surgical Infection:** Surgical infection is major problem in surgical practice. Asepsis (prevention of entry of organisms) and antisepsis (killing of the bacteria in the skin or tissues) has made a difference in surgical practice to prevent the surgical infection.

### **The Criteria for Defining A Surgical Site Infection (Ssi)\*<sup>[3]</sup>**

- **Superficial Incisional SSI:** Infection occurs within 30 days after the operation *and* infection involves only skin or subcutaneous tissue of the incision.

- **Deep Incisional SSI**

Infection occurs within 30 days after the operation if no implant† is left in place or within 1 year if implant is in place and the infection appears to be related to the operation And infection involves deep soft tissues (e.g., facial and muscle layers) of the incision.

- **Organ/Space SSI**

Infection occurs within 30 days after the operation if no implant† is left in place or within 1 year if implant is in place and the infection appears to be related to the operation.

Over 45 years ago, Earle H. Spaulding devised a rational approach to disinfection and sterilization of patient care items or equipment. This classification scheme is so clear and logical that it has been retained, refined, and successfully used by infection control professionals and others when planning methods for disinfection or sterilization.<sup>[3]</sup>

The “Guideline for Prevention of Surgical Site Infection 1999” presents the Centres for Disease Control and Prevention (CDC)’s recommendations for the prevention of surgical site infections (SSIs), formerly called surgical wound infections. It was not until the late 1860s, after Joseph Lister introduced the principles of antisepsis that postoperative infectious morbidity decreased substantially. Lister’s work radically changed surgery from an activity associated with infection and death to a discipline that could eliminate suffering and prolong life.

### **Risk factors for surgical site infections<sup>[4]</sup>**

#### **Patient characteristics**

- a. Diabetes
- b. Nicotine use
- c. Steroid use
- d. Malnutrition
- e. Prolonged preoperative hospital stay
- f. Preoperative nares colonization with *Staphylococcus aureus*
- g. Perioperative transfusion

#### **Prevention of surgical site infection**

##### **1. Preoperative issues**

- a. Preoperative antiseptic showering
- b. Preoperative hair removal
- c. Patient skin preparation in the operating room
- d. Preoperative hand/forearm antisepsis
- e. Management of infected or colonized surgical personnel
- f. Antimicrobial prophylaxis

##### **2. Intra operative issues**

- a. Operating room environment
- b. Surgical attire and drapes
- c. Asepsis and surgical technique

### 3. Postoperative issues

- a. Incision care
- b. Discharge planning

#### Views of *Sushruta* on disinfection

In the '*Nibandhasangraha*' the comentry of *Dalhana* on *Sushruta samhita Chikitsasthan 2<sup>nd</sup>* chapter, it is mentioned about sterilization of instruments before commencing the surgical procedures. He said that flaming of the instruments must be done preoperatively i.e. in *purvakarma*, otherwise it will leads to surgical site infection.<sup>[5]</sup>

In modern aspect, before the surgical procedures this same physical method of sterilization is followed.

In *Ayurveda*, the importance of maintaining the aseptic condition is well explained by *Sushruta*. In *Agropaharniya Adhyaya of sutrasthan* he explained that during intra operative procedure i.e. in *pradhankarma* wound site should be exposed to the fumes of drugs which relieve pain and destroy evil spirits.<sup>[6]</sup>

Further in post-operative period i.e. in *paschatkarma*, fumigation should be done (to the room, cot, clothes, etc. being used patients) with the powder of *guggulu*, *aguru*, *sarjrasa*, and *gaurasarjrasa*, added with *lavana (saindhava)*, *nimbpatra* and *ghruta*. Remains of *ghruta* should be used for restoring his life.<sup>[7]</sup>

Also in *Vranitopasaniya Adhya*, *Sushruta* mentioned that fumigation of the chamber of patient i.e. *vranitagara* should be done for ten days, twice a day without lazyness, using *sarsapa*, leaves of *arista (nimba)* added with *ghruta* and *lavana*.<sup>[8]</sup>

*Sushruta* also discribed the *Mishrak Gana* like, *Arkadigana*, *Eladigana*, *Patoladigana*, *Aragvadhadigana* which should be used for disinfection.<sup>[9]</sup>

**Different Acharya on disinfection:** *Charaka* described 32 *lepa* and *pradeha* in 3rd chapter of *Sutrasthana* the various drugs for formulations in the management of skin infection.<sup>[10]</sup>

*Charaka* also described *mahakashaya* like *kushthagnamahakashaya*, *kandughamahakashaya*, *krumighamahakashaya*, *vishaghnamahakashaya* for the same.<sup>[11]</sup>

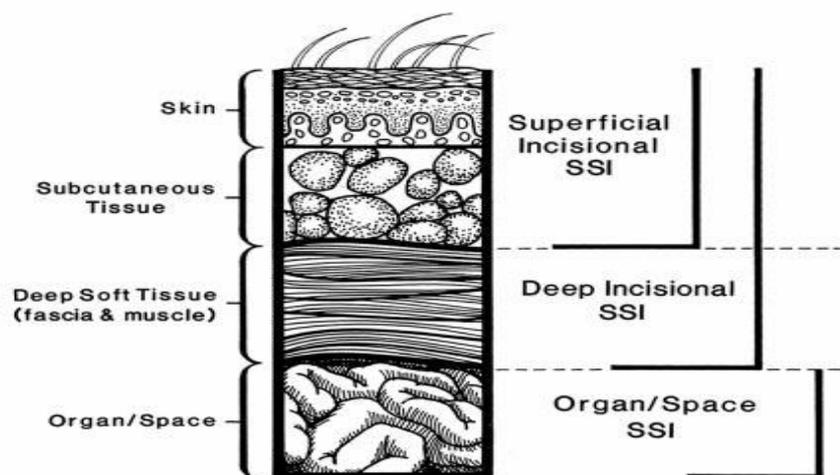
In *Ashtanghridaya Uttarsthan* 1<sup>st</sup> chapter *Balopcharniya Adhyaya*, it was described to tie some of *krimi-hardrava* as *Hingu* (*Ferula foetida*), *Vacha* (*Acorus calamus*), *Sarshapa* (*Brassica campestris*), *Bramhi* (*Bacopa monnieri*), *Jivaka* (*Cuminum cyminum*), on door, head side of bed, in neck of infant which act as disinfectant by repelling insects and thus helpful in better health in children.<sup>[12]</sup>

*Kashyapa* explained drugs for fumigation such as *Nimba* (*Azadirachta indica*), *Guggul* (*Commiphora mukul*), *Sarshapa* (*Brassica nigra*), *Ela* (*Elettaria cardamomum*), *Bhallatak* (*Semecarpus anacardium*) etc. He has also explained different types *Dhoopankalpa*.<sup>[13]</sup>

**Method:** Different classical and modern books, PUBMED database are well scrutinized for the purpose of collecting and reformulating the disinfection and its importance in avoiding the surgical site infection during the different steps of operative procedure.

## RESULT

*Sushruta* is the pioneer of concept of disinfection as he has well elaborated the process of fumigation to avoid surgical site infection. He elaborated the disinfection in steps such as pre-operative, intraoperative and post-operative period to prevent the infection.



**Figure 1: Cross section of abdominal wall showing classification of surgical site infection.**

## DISCUSSION

The *Dhoopankarma* i.e. fumigation characterized under topical treatment for disinfection has been advocated in all classical texts of *Ayurveda*. Various methods of disinfection to prevent the surgical site infection are developed on the base of ancient concept of disinfection. Flaming is type of sterilization which was already explained by *Sushruta*.

*Sushruta* has revealed all the steps for disinfection as in preoperative, intraoperative and postoperative period which is still followed in modern era of medical science. There is a need to evaluate the pharmacodynamics of various herbs or drug whose fumes are mentioned to disinfect the wound or chamber of the wounded patient

## CONCLUSION

In present era, it is necessary to undergo detail study to identify the bioactive chemicals of the formulations and establish their safety and efficacy. By improving and specifying basic principles, methods and formulations of *Dhoopan* we can establish natural, eco-friendly and cheap tool to combat microbes. It is necessary to have more detailed and systemic evaluations of ancient method used for sterilization in pharmacodynamics and phytochemical view.

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