Conceptual review of asepsis, antisepsis & sterilization in Ayurveda.

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Abstract:
Sterilization is the process of freeing an article, a surface or a medium of all microorganisms. Asepsis is the state of being free from or keeping away disease-producing microorganisms like bacteria, viruses, etc. For the success of any surgical treatment Sterilization and Aseptic precautions are of prime importance. Lack of sterilization and aseptic precautions leads to complications, infection, delayed wound healing, etc. Now a days in modern era there are various chemical & physical methods of sterilization. But the concept of ancient Sterilization and Asepsis is same, cost effective, having medicinal values also. The ancient Acharyas used Agni (Fire), Kwath (Decoction) & various medicated fumigating yogs to protect Atur (patient) from different organisms. The ancient Acharyas mentioned various Dhoopan with Rkashoghanyadravyas for sterilization of OT rooms with that explain some aseptic precautions. So, an effort is made to establish an Ayurvedic sterilization and Aseptic Technique in this era.

Keywords: asepsis, antisepsis, sterilization, kushtaghna, kandughna, krumighna

Introduction:
In our surrounding environment there are billions of microorganisms. From which some are hazardous to human being mainly to immune-compromised hosts. Such organisms may prove dangerous in open wounds, in OT, in patient wards, in neonatal wards, in labor rooms, where host defense mechanism is not that much to protect against these pathogens. They may enter and cause disease in host that affect recovery after operation and also increase the patient hospital stay. Thus, proper sterilization, disinfection and aseptic precautions play a major role to deal or to avoid such consequences. The sterilization can also be translated in ayurvedic context as Nirjantukikaran or Rakshakarma.

Ayurveda explains a variety of techniques for keeping macro or micro
organisms from harming a patient's wellbeing or destroying them. They go over things like Dhoopan, Vranshodhan, Vranbandha, the surgeon's and patient's hair and nails being cut, wearing clean white clothing, Yam, Niyaman, and so on. They used different terms for macro organisms in ancient samhitas, such as krimi, makshika, and so on, but they don't recognize or justify microbes or germ theory. However, references in ancient samhitas such as bhutbadha, grahabadha, and pak uttapti in wounds suggest the presence of microbes or germs.

Ancient Acharya's give so many importance to Shuchi i.e. cleanliness for patient health point of view. They mentioned cleanliness regarding vaidya (surgeon), atur (patient), vranitagar (IPD). But in modern era same concept & importance of cleanliness in surgery was mentioned or pointed out in 1847 by Hungarian physician Ignaz Semmelweis. After that the sepsis, antisepsis, asepsis terms established. Sepsis defined as a serious condition resulting from the presence of harmful microorganisms in the blood or other tissues & the body's response to their presence, potentially leading to the multi failure of various organs, shock & death. Antisepsis defined as Preventing the growth of disease-causing microorganisms. Asepsis defined as the exclusion of bacteria & other microorganisms, typically during surgery.

Acharyas listed various ways to keep Tridosha in Samyak sthiti.

There are several references in Ayurved classic which point out to asepsis & sterilization. They have been complied below.

For Vaidya (Surgeon):

- तन्यरोपणं शुचिः शुचिवास्तःस्पर्शितं चतुर्वत
  ता दण्डहस्ते सोपावथकान्तुदात्तवेशेऽवृत्ते सुमनसा कल्याणाभिव्याहरेणाकुम्हकथः कादित्रे सुमनसा सुसाहयकता वैद्यन विशिश्वास नुप्रवेष्टा
  यथा || जै || सु सु १०३ (सु चि २/५७)

In Yogasutriya Adhyay, after being purified from bathing and cutting the nails and hair, Vaidya joins the Visikha (operation Theater) wearing a clean, white dress.

- प्रक्षाल्य पश्चात् तृणशोणणताप्त तुरुश्चिताः
  तृणशोणणताप्त तुरुश्चिताः प्रवेशयेत्
  कृत्तनखो घृतेनाक्तं शनैं शनैं ||
  प्रवेशयेत् कृत्तनखो घृतेनाक्तं शनैं
  शनैं || (सु चि २/५७)

- प्रक्षाल्य पश्चात् तृणशोणणताप्त तुरुश्चिताः
  तृणशोणणताप्त तुरुश्चिताः प्रवेशयेत्
  कृत्तनखो घृतेनाक्तं शनैं शनैं ||
  प्रवेशयेत् कृत्तनखो घृतेनाक्तं शनैं
  शनैं || (सु चि २/५७)

In abdominal open trauma when intestine get infected with soil, blood or other substances then it should be cleaned with milk and properly inserted back into abdomen with cleaned hands having cutting nails.

अग्नितप्तेन शस्रेन छछन्द्यात्
अन्यथा अतप्त शस्रच्छेदन्ने
पाक्यं स्यात्।

अग्नितप्तेन शस्रेन छछन्द्यात्
अन्यथा अतप्त शस्रच्छेदन्ने
पाक्यं स्यात्।

Until making an incision, the blade or instruments should be fired; if not, the clean wound would become infected, resulting in pus forming.
For Atur (Patient):

- प्रशस्तवास्तुचिति गृहे शुचावातपवजिते न च रोगा: स्यु: शारीरागन्तुमानसा: ||

In Vranitapasniya Adhyay, Vranitagar (IPD) built in the expansive land, which is pure and is prohibited from direct sunlight, and is devoid of air vents, living in it does not cause physical mental diseases.

- तस्मिन्न शयनसमिबाधिन्स्वास्तीणमनोज प्राग्क्शरस्कं सशस्रं कुवीत|

Patient’s bed should be laid in such a wide house and properly fitted and cover with clean cloth.

- सदा नीचनवोम्णा शुचचना शुचवाससा|

Patient should always have a short fingernail and short hair, wearing a holy, white garment.

- न तुदेन्न च कण्डृवेच्छयान: परिपाल्येत

Ulcers should not be scratched which may get infected due to infected nails and leads to impaired wound healing.

- तत्सूरैकदेशं च कुमारस्य ग्रीवायां सम्यग्ब ध्नीयात|

After cutting the umbilical cord from placenta of infant, tie it well in the neck of the infant with the help of thread so that it could not get infected by urine and stool of infant itself.
The pain, pus discharge at the sight of wound should get disinfected by letting the fumes of Guggula, Grita, Yava. This will lead germ free wound & healing with acceleration.

Shushruta has said vranadhoopan gives in a manner that medicated steam produced by ayurvedic drugs is applied to the wound in SharavSamputa (Closed container made by soil).

When wound is infected with worms or insects it should be cleaned & disinfected by giving Dhavana (Wash) of ayurvedic formulations (Kwathkalpna) of Surasadigana.

In Charak Sutras a chapter dealing with Janopdodhvamsa (Epidemics), in that many measures for purification of air, water, soil. These are aimed to control and elimination of harmful macro & microorganisms.

Charak in sutras chapter (Arvgadhiyam) Has describe 32 Lepa & Pradeha (Drugs for local application) consist of various drugs formulations in management of skin diseases like

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<th>Sr. No.</th>
<th>Name of Mahakashay</th>
<th>Content</th>
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<tbody>
<tr>
<td>1</td>
<td>Kushtaghna</td>
<td>Khadir, Abhaya, Amalki, Haridra, Arushkar, Saptaparna, Argyadha, Karvir, Wavding, Jatipraval</td>
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<td>2</td>
<td>Kandughna</td>
<td>Chandan, Jatamansi, Kruutmal, Naktmal, Nimb, Kutaj, Sarshap, Madhuk, Daruharidra, Musta.</td>
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<td>3</td>
<td>Krumighna</td>
<td>Akshiv, Marich, Snuhi, Kebuk, Wavding, Nirgundi, Kinhi, Gokharu, Vrushaparnika, Akhuparni.</td>
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In arkadigana plants like arka, Alarka, Karanjadvya, Nagadanti, eczema, scabies, leprosy, etc. which acts as a Krumighana.

In Charak Chiktstasthan 23rd chapter there is formulation for fumigation which would kill serpents, rats, insects of clothes. The herbs enumerated are Jatu, Sevya, Guggul, Bhalata, Kakubhapushpa, Sarjaras. In Vranchikitsa also there are formulations for local irrigation, application & fumigation to be used for vranshodhan (vran cleansing and purifying) which acts as a disinfectant.
Mayuraka, Bhargni, Rasna, Indrapushpi, Ksudrasveta, Mahasveta, Alavana are said to have property to cure Krumi (worms), Kustha (skin diseases), Vranavishodhana (wound cleansing & purifying).

In Astang Sangraha Uttarsthan chapter-1 it is described to tie a cotton pouch containing Hingu, Vaca, Turuska & sarsapa on the upper frame of door & head side of bed & also in neck of infant & mother for protection which possible acts as repellent for insects. They also mentioned of fumigants for baby’s room consisting of dried crow feathers with Trivrta, Vaca, Kustha, Sarsapa with little Gruta.

In Astang sangraha Chapter -38 also there is a mention of Vrana-RaksoghnaDhupa consisting of Guggulu, Agaru, Sarjarasa, Vaca,Hingu, Lavana,Nimbapatra, Ghruta for fumigation of wound. This also mention in Uttarshan chapter-1 for protection of newborn, infant.

Astang sangraha Uttarsthan chapter-8 contains many formulations which appear consisting of natural biocides & fumigants to cure various infantile Grahabadha (pediatric idiopathic syndrome).

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<th>Sr.No</th>
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<th>Latin Name</th>
<th>Active Ingredient</th>
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<tr>
<td>1</td>
<td>Nimba⁴⁰,⁴¹</td>
<td>Azadiracta Indica</td>
<td>Azadirachtin, Quercetin, Catechin</td>
<td>Insecticidal, Antibacterial, Antifungal</td>
<td>Mohammad Zahirul Islam , Original scientific paper UDC 635.64-23/- 24:632.9(519)</td>
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<td>5</td>
<td><em>Haridra</em>&lt;sup&gt;27,28&lt;/sup&gt;</td>
<td><em>Curcuma Longa</em></td>
<td>Curcumin</td>
<td>Antibacterial, Antifungal</td>
<td><em>Niamsa, N.; Sittiwet, C. Journal of Pharmacology and Toxicology</em> 2009 Vol.4 No.4 pp.173-177 ref.18</td>
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<td>6</td>
<td><em>Jatamansi</em>&lt;sup&gt;29,30&lt;/sup&gt;</td>
<td><em>Nardostachys Jatamansi</em></td>
<td>Ursolic acid, Oleanolic acid</td>
<td>Antiviral</td>
<td>Surendra Kumar, Vol 5, issue 3, June 2012, pages 112-118 (Journal of acupuncture &amp; meridian studies)</td>
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<td>7</td>
<td><em>Tulasi</em>&lt;sup&gt;31,32,33&lt;/sup&gt;</td>
<td><em>Ocinum Sanctum</em></td>
<td>Ethanoic acid, Chavicol, Linalool</td>
<td>Antibacterial, Antifungal</td>
<td>Agraval pooja Nagesh Indian Journal of Dental Research, Jul-sep 2010, vol 21, issue 3, page 357-359</td>
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**In Modern Era:**

In era of 18<sup>th</sup> century, in 1847 the Hungarian physician Ignaz Semmelweis 1<sup>st</sup> mention the importance of cleanliness in surgery. He is known as pioneer of Antiseptic procedures. His hypothesis that there was only one cause for puerperal fever in women, that all mattered was cleanliness, was extreme at that time & was largely ignored & rejected. In the same era, the British surgeon Dr. Joseph Lister promoted the idea of sterile surgery. He successfully introduced Carbolic acid (Phenol) to sterile surgical instruments & to clean wounds. In 1843, Sir Oliver Wendell Holmes said about “Germ Theory of Disease – that the cause of puerperal fever.” He believed that bed sheets, washcloths & article of clothing were of particular concern in this regard. Later on, many more new techniques, methods of sterilization, asepsis & antisepsis are developed.
Methods of Sterilization:

**Physical Methods**

- **Heat**
  - **Dry Heat**
    - *Red heat*
    - *Flaming*
    - *Incineration*
    - *Hot air oven*
  - **Moist Heat**
    - *Temperature below 100°C*
    - *Temperature at 100°C*
    - *Temperature above 100°C*
- **Radiation**
  - **Non-Ionising**
    - *Infrared*
    - *Ultraviolet*
  - **Ionising**
    - *X rays*
    - *Gamma rays*
- **Filtration**
  - *Depth filter*
  - *Membrane filter*
  - *Air filter*

**Chemical methods:**
- Alcohols: Ethyl, isopropyl
- Aldehydes: formaldehyde, glutaraldehyde
- Phenols
- Halogens
- oxidizing agents
- Salts
- Dyes
- Gases: ethylene oxide, Formaldehyde

While constructing the operation theater some features are followed which are as follows:
- A continuous flow of highly filtered ‘bacteria-free’ air is reticulated under positive pressure into the operating field and air contaminants generated during surgery are removed from the site.
- With anti-bacterial paint - has minimum durability of 15 years. Seamless.
- Easy to clean steam cleaned, electro metric (ideal for high humidity areas). 
- Vapor permeability (allows substrate moisture to escape) protects against growth of bacteria, mould and yeasts
- Moisture resistance, freeze / thaw resistance.

**Conclusion:**
It can be evident that the maximum drugs mentioned in auyrvedic texts have antibacterial properties and very much effective against bacterial opportunistic infections. The ancient science also has the idea about the foreign infections. They also stated the various methods of disinfections, sterilization & aseptic precautions which have been used at that time. By the times lots of revolutions
takes place. There are many methods of sterilization are available in today’s modern science which are based on same principles mentioned in classical text. It necessary to have more detailed & systemic evaluations of ancient method used for sterilization in pharmacodynamic & phytochemical view.

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