

## CRYONANO PROBEDESIGN& CRYOGENIC TECHNIQUES

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### ABSTRACT

Cryoprobe technology was used to design the cryogenic probe ,and the same was analyzed. Penne’s Bioheatequationsare used to solve heat transfer mechanism.To optimize the freezing and to enhancement in the freezing heat transfer and to increase freezing effects and more ice nucleation and there by minimize the surrounding healthy tissues being frozen the nanoparticles are loaded, which are very much required for the successes cryosurgery. This was done with the help of a device called cryospray or cryojet with different types of cryoprobes, till ice ball is formed. Various caliber probes gives better ice volume and surface area of heat transfer .Cryosurgery techniques and equipment was successfully applied in the fields of engineering and and in many branches of medicine such as Cardiology, Oncology, dermatology, gynecology, urology, neurology, pulmonary medicine.It is also used in veterinary medicine.

**Keywords:** Cryosurgery, cancer, freezing,thawing and warming

### 1. INTRODUCTION

Cryosurgery is an important ablation technique for tumors. anddestroys tumors by cycles of freezing and thawing .Cryosurgery's destructive effects on tumors are due to two major mechanisms, one immediate, the other delayed.Cryosurgeryis low temperature application to treat cancer and is often used to treat cancer because of its minimal pain ,scarring and cost.Cryosurgery is used to treat several types of cancer, and some precancerous

or non-cancerous conditions. Cryosurgery is also used to treat some types of low-grade cancerous and non-cancerous tumors of the bone. The mechanisms of cryosurgery are the effect of cooling, the effect of freezing, thawing and warming. Cryo surgery is accepted and approved by many countries. Applications of cryogenic techniques have been used in cryo surgery.

## 2. LOW TEMPERATURE SURGERY (FREEZING)

Cryoablation is a surgical technic that employs freezing at cryogenic temperatures to destroy undesirable tumor cells. cryosurgery is effected by means of a cryosurgery device called cryoprobes either by placing its continuously cooled tip on or into the tissues to be destroyed. The technique is used to treat tumors where conventional surgery would be difficult. The Cryosurgery has a typical success rates compared to those of traditional open surgery.

## 3. NANOTECHNOLOGY

Nanomedicine is the medical application of nanotechnology. Nano medicine ranges from the medical applications of nanometer's to nonelectric biosensors, and even possible future applications of molecular technology. Nanotechnology has the potential impact to surgical practice. Molecular nanotechnology is speculative subfield of nanotechnology. Molecular nanotechnology is highly theoretical one. The proposed element of molecular nanotechnology is molecular assemblers and nano robot. It has wider applications in all the field and one of its important application of nanotechnology is Cryonics.

## 4. GOVERNIG (BIO HEAT) EQUATIONS

$$C_f = C_f t(1 - \phi) + C_p \phi$$

$$C_u = C_u t(1 - \phi) + C_p \phi$$

Where **f** is frozen mixture and **u** is unfrozen mixture.

$$\frac{\partial(Ph)}{\partial t} = \nabla \cdot (\nabla kt) + \rho_b C_b \phi_b (T_b - T) + q$$

## 5. METHODOLOGY

A new thermal model probe was designed and analyzed to solve the problems in cryogenicsurgery. To increase the tissue conductivity, significant freezing effects and more efficient ice formation, alumina alpha (Al<sub>2</sub>O<sub>3</sub>) nanoparticle solution is loaded for administrating the cryonanosurgery. Cryosurgical treatment is performed with mini cryogun or cryojet (model Inc-196) liquid nitrogen storage devices adapted to different types of cryoprobes used in the cryosurgery till ice ball is formed.

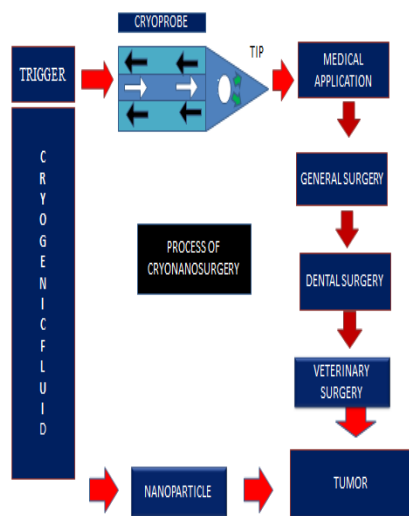


Fig1 processes of cryonanosurgery

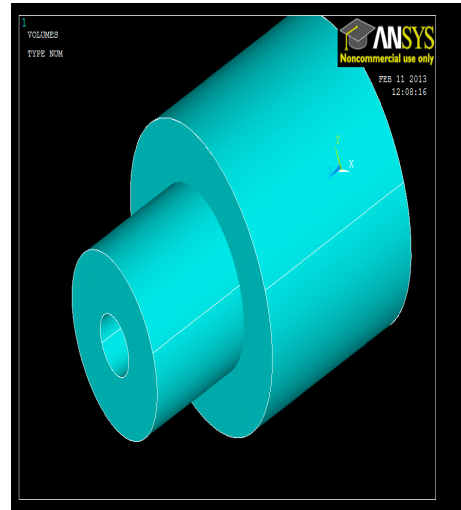


Fig2 design of cryospray

## RESULTS & DISCUSSION

Using various caliber probes or using different diameter probes or simultaneous placement of more probes and using different cryogen also gives better results. Different diameter of cryoprobes and materials minimize the freezing/thawing cycle. Cryonanosurgery is very simple, flexible, indispensable and relatively comfortable and also gives better results.

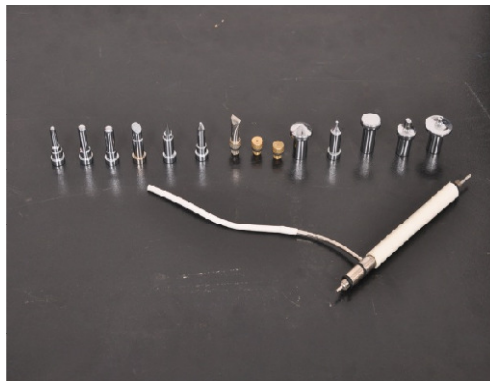
Parameter	Unit	Value
Blood perfusion rate	ml.s <sup>-1</sup> ml	≤0.011
Metabolic heat generation	KWm <sup>-3</sup>	33.8
latent heat	MJ.m <sup>-3</sup>	250
specific heat of frozen tissue	MJ.m <sup>-3</sup> °c <sup>-1</sup>	1.8
specific heat of unfrozen tissue	MJ.m <sup>-3</sup> °c <sup>-1</sup>	3.6
Thermal conductivity of frozen	w.m <sup>-1</sup> °c <sup>-1</sup>	0.5
Thermal conductivity of unfrozen	w.m <sup>-1</sup> °c <sup>-1</sup>	2
Blood temperature	°c	37

## 7. CONCLUSION

By increasing outputs or adding cryoprobes, a ball can be expanded to kill nearly any size of tumor. Any number of probes can be inserted and cooled simultaneously, and the process of cooling can be monitored with ultrasound, which gives (hypo echoic) a dark image when the tissue is frozen. It is just a beginning to investigate cryonanosurgery, but a lot of fundamental understanding of the mechanisms of tissue damage is required during

cryosurgery .many critical and complex factors still not clear are to be studied and investigated ..Further study and investigations would be on bothimproved cryosurgical device technology andmathematical cryosurgery optimization techniques Further studyisto develop improved imaging techniquesIt is anticipated that cryosurgery will become a standard technique in the minimally invasive surgeon armamentarium. The mechanisms of cryosurgeryare the effect of cooling.the effect of freezing.thawing and warming

**Fig3** Cryoprobetips



## 8. ACKNOWLEDGMENT

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