Radiant Warmers

Lack of attention to thermoregulation continues to be a cause of unnecessary deaths in the neonatal population. Maintaining a stable body temperature is essential to ensure optimal growth. If temperature is maintained, caloric expenditure and oxygen consumption would be minimal. Newborn babies, in particular, the preterm and the low birth weight are exquisitely predisposed to hypothermia. No other equipment is identified more with the special care of newborn babies than the radiant warmers.

Radiant warmers provide intense source of radiant heat energy. They also reduce the conductive heat losses by providing a warm microenvironment surrounding the baby. The radiant warmer (also called open care system) was developed as an ‘open incubator’ that ensures ready access to the baby. The overhead quartz heating element produces heat which is reflected by the parabolic reflector on to the baby on the bassinet. The quantity of heat produced is displayed in the heater output display panel. Temperature selection knobs select the desired skin temperature. This information is processed by the microprocessor inside the control panel and matched against the actual temperature of the baby. If the temperature of the baby is lower than the set temperature, the microprocessor will send feedback to the quartz rod heater to increase the heat output till the baby’s temperature reaches the set temperature. At this point, the heater output will be reduced. This system in which the heater output is determined automatically based on skin temperature information is called servo system. Servo system is the preferred method of running the open care system. The heat output from the quartz heating rod could also be increased or decreased manually. This is done by the heater output control knobs. This is called the manual mode of operation. In the servo mode, whenever the baby’s temperature rises by more than 0.5°C above the set temperature, a visual/audible alarm is activated. Caregiver must pay attention to sort out the fault. Often this occurs when the temperature probe comes off the baby’s skin.

Parts of open care system
- Bassinet  
  For placing the neonate
- Quartz rod  
  Provides radiant heat
- Skin probe  
  When attached to the baby’s skin, displays skin temperature
- Control panel  
  Has a collection of display and control features/knobs
- Heater output display  
  Indicates how much is the heater output
- Heater output control knobs  
  For increasing or decreasing the heater output manually
- Temperature selection panel
Select either set temperature or skin temperature

- Temperature selection knobs
  Select a desired set temperature

- Temperature display
  Display temperature as selected, either of the baby’s skin (via skin probe) or the set temperature

- Mode selector
  Selects manual or servo mode

The heating element (silicon quartz/infrared/ceramic/quartz crystal), the control panels (electronic/electrical/microprocessor based) and alarms (air over temperature/skin over temperature/air sensor fail/power failure etc.) forms the basic unit of all the warming devices. Power consumption is around 750 watts. In good equipment, temperature stability is usually with an accuracy of ± 0.5°C.

**Steps for use of warmer**
1. Connect the unit to the mains. Switch it on.
2. Select manual mode.
3. Select heater output to 100% for sometime to allow quick pre-warming of the bassinet covered with linen.
4. Select servo mode.
5. Select the desired set temperature of baby as 36.5°C.
6. Place the baby on the bassinet.
7. Connect skin probe to the baby’s abdomen with sticking tape.
8. If you want the manual mode to be used, select the desired heater output.
9. In the manual mode, record baby’s axillary temperature at 30 minutes and then 2 hourly.
10. Respond to alarm immediately. Identify the fault and rectify it.

**Application of skin probe**

*Do’s*
1. Prepare the skin using an alcohol/spirit swab to ensure good adhesion to the skin.
2. Apply probe over the right hypochondrium area in the supine position.
3. Apply probe to the flank in the prone position.
4. Check sensor probe regularly so as to ensure that it is in place. Ensure that skin probe is free of contact with bed.
5. Cover probe with a reflective cover pad, if available (foil covered foam adhesive pad).

*Don’t*
1. Do not apply to bruised skin.
2. Do not apply clear plastic dressings over probe.
3. Do not use fingernails to remove skin surface probes.
4. Do not reuse disposable probes.
**Use of cling wrap to decrease insensible water losses**

Use of cling wrap (transparent polythene used for covering fruits or vegetable for storage) over the baby, tied across the panels of warmer, has been shown to reduce insensible water losses and result in better thermal control for VLBW(<1.5 kg) babies.

**Potential pitfalls of servo-controlled warmer**

In the event of probe getting displaced from baby’s abdominal skin, overheating of the baby will occur because the skin probe depicts air temperature and heater output keeps on increasing till probe temperature matches control temperature. Also, repeated activation of alarm will occur when baby develops fever. In this situation, it is better to shift to manual mode with least heater output.

**Useful tips for use of radiant warmers**

- Don’t use the warmer in a cold room. It works best when the environmental temperature is above 20°C.
- Keeping the warmer where there is lot of air currents reduces its efficiency.
- The warmer must be pre-warmed around 20 minutes before the arrival of the baby or till the set temperature is reached with less than 50% of total heater output.
- While using the manual mode in a warmer without a temperature display, record the baby’s temperature regularly, preferably 2 hourly.
- Train junior doctors and nurses about the proper use of servo and manual modes.
- The manual mode is used for initial preparation of bed for the baby or when rapid warming of a severely hypothermic baby has to be done. However, this may be hazardous as babies may become overheated. Except in the continuous presence of a nurse who is watching the skin temperature, it is preferable to use the skin probe with the warmer on servo-mode.

**Disinfection**

When the equipment is in use, all approachable external surfaces should be cleaned daily with an antiseptic solution like 2% bacillocid or gluteraldehyde. *Spirit or other organic solvents must not be used to clean the glass side panels or display panel.* For disinfection of reusable probe, isopropyl alcohol swab should be used. Every seventh day, after shifting the baby to another cot, the used equipment should be cleaned thoroughly, first by light detergent solution and then by antiseptic solution. All detachable assemblies, are to be treated similarly.

**Maintenance**

Ongoing maintenance is the key to increase the mean time between failures. The hospital biomedical engineer must regularly check equipment but the authorized company engineer must be called for preventive checks and major breakdowns. The control and power units should be calibrated every 4-6 months and thorough servicing should be
done annually. Temperature calibration should ensure sensitivity to $\pm 0.5^\circ$ of the set value.

Costs, models and dealers

Cost may vary according to the make and are listed below in Table 3.1.

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Indian</th>
<th>Imported</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Radiant Warmer</td>
<td>15-35</td>
<td>50-60</td>
</tr>
<tr>
<td>Manual controlled</td>
<td>25-70</td>
<td>150-300</td>
</tr>
<tr>
<td>Servo controlled</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Costs vary widely with additional features

Manufacturers

**Indian:** Shreeyash Electro Medical (Pune), Zeal Medical (Mumbai), Meditrin (Mumbai), Phoenix (Chennai), Bird Meditech (Mumbai), Medicaid (Delhi), Mediserve (Delhi), Mech Tech Lab (Pune), Lectromedik Pvt. Ltd. (Bangalore).

Dealers of imported brands

**Principals**

Ameda (Switzerland)
Datex-Ohmeda GE
Ginevri (Italy)
Fisher Paykel
Premicare (U.S.A.)
Weyer Gmbh (Germany)
DMT Dragerwerck AG (Germany)
Heraeus (Germany)
Atom (Japan)
Hill Rom Air Shields (U.S.A.)

**Dealers**

Medisphere
Phoenix Medical System
Global Medical System
Fisher & Paykel
Moola Tools Pvt. Ltd.
Rustagi Surgicals
Drager
Medex
Vishal Surgicals
PES Installations Pvt.Ltd, Drager

Conclusion

The use of warmers is now firmly established in special care units. The sophistication of equipment has also reached a mature state. Familiarity with the equipment and the control system, proper use, cleaning, disinfection and daily maintenance are of paramount importance.

On the whole, Indian warmers have greatly improved in quality over the last decade. Their costs have also increased simultaneously. A variety of models from both Indian and foreign companies are available. In general, imported models still give longer trouble-free service and more accurate temperature control. However, with the cost of a single imported unit, one can buy two to four Indian products. The bottom-line is the quality of after-sales service, which often is equally unsatisfactory whether the companies deal with
indigenous or imported equipment. It is best, therefore, to consult other colleagues using different models before purchasing one. Apart from quality and performance of a model, its cost, availability of spare parts, and servicing facilities are also important considerations.

Frequently asked questions (FAQs)

Q1. What tips should be followed for the use of open care system?

Tips for use:

1. Connect the unit to the mains. Switch it on
2. Select manual mode.
3. Select heater output to 100% for sometime to allow quick pre-warming of the bassinet covered with linen.
4. Select servo mode.
5. Select the desired set temperature of baby at 36.5°C.
6. Place baby on the bassinet.
7. Connect skin probe to the baby’s abdomen with sticking tape.
8. If you want the manual mode to be used in the baby, select the desired heater output.
9. In manual mode, record baby’s axillary temperature at 30 minutes and then 2 hrly.
   Respond to alarm immediately. Identify the fault, rectify it.

Q2. What precautions should be followed for application of skin probes?

1. Do not apply to bruised skin.
2. Do not apply over clear plastic dressings.
3. Do not use fingernails to remove skin surface probes.
4. Do not reuse disposable probes.
5. Shield skin probes with reflective pad, if possible, under radiant warmer.
6. When using servo-control mechanisms for environmental control, take intermittent temperatures at other sites to monitor effect. Check sensor probe regularly so as to ensure that it is in place.

Q3. What is the technique for application of skin probes?

1. Prepare the skin using an alcohol/spirit swab to ensure good adhesion to the skin.
2. Apply probe over the right hypochondrium area in the supine position.
3. Apply probe to the flank in the prone position.
4. Ensure that skin probe is free of contact with bed.
   Cover probe with a reflective cover pad (foil covered foam adhesive pad).

Q4. What are the advantages & disadvantages in using a warmer?
**Advantages**

1. Easy accessibility
2. Easy to connect the tubes of ventilated baby and do procedures
3. Better monitoring especially if the baby has respiratory distress
4. Less risk of infection as compared to closed incubator
5. Can be used as resuscitation trolley in the labor room

**Disadvantages**

1. More insensible water losses
2. Not uniform heating as compared to closed system
3. More risks of episodes of hypothermia

Q5. **Do one need to record baby temperature if baby is under radiant warmer?**

Yes, the axillary temperature must be recorded and documented as per nursery policy. Compare this with the depicted display temperature. This gives the opportunity to be sure that the warmer is working all right and baby is not over or under heated.

Q6. **If baby is having higher temperature, how one can be sure that this is due to illness in the baby or overheating by warmer?**

If baby is having fever, examine the baby carefully. A baby who is overheated due to radiant warmer will have his skin flushed and also his sole/palms will be warm to touch in addition to the warm abdomen. Malfunction of equipment – probe getting disconnected or keeping baby in manual mode with high heater output can explain this situation. On the other hand, fever due to any illness will result in warm abdomen to touch but palms/soles will be cold to touch (gradient between abdomen and palms/soles temperature). In addition, clinical examination will reveal features that point towards sepsis in the baby.