

1. Background on Neuroblastoma and MIBG Treatment

Neuroblastoma is a childhood tumor cancer that forms in the nervous system outside the brain. It can occur with different degrees of aggression, labeled low-, intermediate-, and high-risk. Approximately 50% of children with neuroblastoma will have high-risk disease. MIBG (meta-iodobenzylguanidine) is a molecule that is combined with radioactive iodine to treat neuroblastoma. After MIBG is injected into the patient, the MIBG is absorbed by neuroblastoma cells. MIBG permits treatment of patients with relapsed neuroblastoma. This treatment has shown great promise in extending survival and diminishing pain for patients with few other treatment options.

2. Techniques for Lowering Radiation Exposure

2.1. Education to Caregivers and Nursing Staff

Boston Children's Hospital Radiation Safety Office (RSO) provides education to parents or guardians of MIBG patients to ensure that they understand their role as a caregiver during their inpatient stay. Allowing caregivers to perform certain tasks which do not require clinical expertise helps reduce the cumulative dose of our nursing staff who are required to care for MIBG patients multiple times a year.

MIBG patient caregivers should perform the following tasks:

- Distribute oral medications
- Deliver food and assist in feeding when necessary
- Empty the foley catheter
- Assist in bathroom use
- Emotional support

2.2 Contamination Control

The RSO educates nursing staff and caregivers on what personal protective equipment (PPE) should be worn and when to ensure that radioactive contamination is kept inside of the patient room.

PPE Requirements:

- Gown
- 2 pairs of gloves
- Shoe Coverings

2.3 Shielding

MIBG patients are cared for in a room designed to shield radiation from this specific treatment with the use of lead lined walls. To aid in lowering doses to those who are required to work in the room, the RSO arranges shields inside of the patient room. These shields are portable to allow room configuration to change based on the needs of the patient. Current MIBG protocols require a foley catheter placement. To limit the radiation exposures inside of the room, the foley bag is kept in a lead lined box.

2.4 Time

Time spent in the patient room is to be kept to a minimum. Nursing staff should only enter the room when clinically necessary and caregivers should only enter the room when performing activities described in section 2.1.

2.5 Distance

Distance from patient is to be kept as far as is reasonable during activities in the patient room.

3. Techniques for Monitoring Radiation Dose

3.1. Electronic Dosimeter Badge Real time dose viewing allows caregivers and nursing staff to monitor their exposure while they are performing tasks inside of the patient room.

3.2. Instadose + Dosimeter The instadose+ dosimeter allows the RSO to monitor dose on a frequent basis. This allows the RSO to make changes to techniques and practices that may be contributing to dose in a timely manner.

4. Dose Comparison

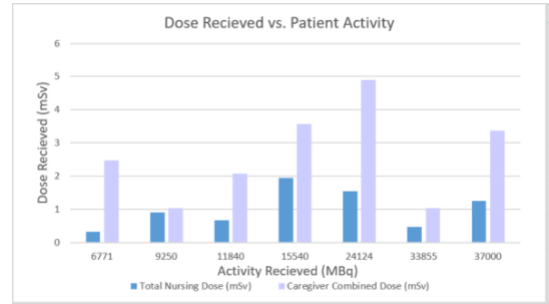
Activity injected is patient weight specific and may be up 37,000 MBq of I-131. Although an increase in dose is expected to be directly proportional with an increase in activity, that is not always the case. Dose received by occupational workers, in this case nursing staff working with MIBG patients, depends on factors that affect the amount of time they will ultimately need to spend in the patient room.

Factors Effecting the Amount of Patient Care Required by Nursing Staff:

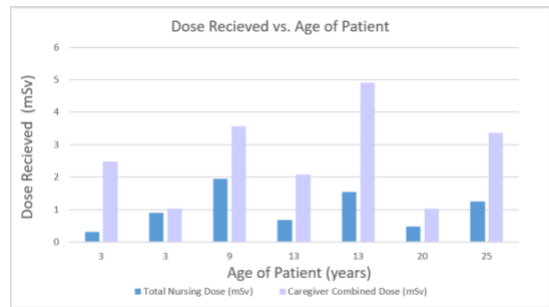
- Reliability of caregivers
- Age of patient
- General health/disease state of patient

4.1 Cumulative Dose Received during MIBG Stay

Dose data represented in the below graph compares the cumulative nursing dose received during an inpatient stay vs the cumulative caregiver dose received during an inpatient stay for a specific activity.



Dose data represented in the below graph compares the cumulative nursing dose received during an inpatient stay vs the cumulative caregiver dose received during an inpatient stay for patients at various ages.

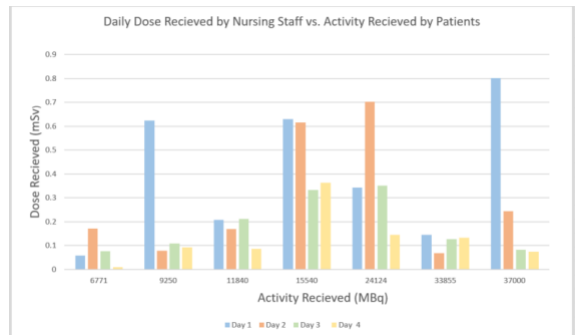


We tend to see that patients who receive higher doses of MIBG are generally older and require less care during their inpatient stay. Thus, we observe a lower dose received by caregivers and nursing staff.

4.2 Daily Dose Received by Nursing Stay during MIBG Stay

The effective half-life of I-131 is ~24 hours. Although there is a decrease in activity over the course of the inpatient stay, we do not always observe a decline that is directly proportional to the decrease in activity present in the patient room.

Dose data presented in the below graph compares the cumulative nursing dose received on each day involving care of an MIBG patient vs. the activity administered.



Dose data presented in the below graph compares the cumulative nursing dose received on each day involving care of an MIBG patient vs the age of the patient.

