



# Incidence of Local Pin-Site Inflammation After Gamma Knife Procedure

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**ABSTRACT:** Little is known about the localized inflammation that patients experience after gamma knife stereotactic radiosurgery (GKSR) or a stereotactic biopsy (SB) procedure. This study was conducted to gather and compare baseline data of local pin-site inflammation in patients with GKSR and SB in the early postprocedural period. This was a prospective, nonrandomized observational study of current practice. Eligible patients were consented and surveyed in-person or via phone, 24 hr and 7 days after procedure, regarding inflammation at pin sites. This study included a total of 59 subjects aged 26-77 years. Inflammation of at least one pin site was seen in 37 subjects. One subject developed a superficial infection requiring oral antibiotics. There was no statistical difference in inflammation between SB and GKSR subjects. There was a higher rate of inflammation at 1 week for frontal pin sites. Localized inflammation was more common than hypothesized after GKSR and SB. Patients should be educated about pin-site inflammation after GKSR. Early post-treatment follow-up should be performed and include assessment for pin-site inflammation. Pin-site inflammation that persists after 7 days should be visually assessed for possible localized infection. (*J Radiol Nurs* 2016;35:243-247.)

**KEYWORDS:** Gamma knife; Stereotactic biopsy; Infection; Surveillance.

## INTRODUCTION

Gamma knife stereotactic radiosurgery (GKSR) is an outpatient procedure used to treat certain intracranial tumors. This procedure uses a stereotactic technique to guide the delivery of radiation to tu-

mors by defining an intracranial target using specific coordinates. This procedure has been shown to effectively control tumor growth ([Vachhrajani et al., 2008](#)).

Many patients undergoing GKSR report signs and symptoms consistent with local inflammation at the sites used to attach the frame to the patients' skull, called pin sites. Although cerebral tissue inflammation has been reported as a complication after gamma knife procedures ([Sanborn et al., 2011](#)), there are no studies that examine localized inflammation at the pin sites of the head frame attachment. This study compared the incidence of localized inflammation at pin-site insertion among patients undergoing GKSR and patients undergoing stereotactic biopsy (SB) and examined differences in the incidence and severity of localized inflammation between these two procedures.

## BACKGROUND

GKSR was initially developed by Lars Leksell and Borje Larrson in an effort to treat lesions in the brain

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without harming the surrounding tissues ([Why Gamma Knife Surgery?](#), 2015). The first tumor treated with the initial prototype of the Gamma Knife was in 1967. Today, there are >70,000 GKSR procedures performed each year ([Why Gamma Knife Surgery?](#), 2015). The procedure involves attaching a rigid head frame to the skull which allows for a localizer device to be attached and three-dimensional (3D) measurements to be taken and plotted. Although the number of beams varies by system, this setup allows for the accurate delivery of up to 192 beams of low-dose gamma rays ([Lunsford et al., 1989](#)) that, when combined, administer the prescribed dosage of radiation to a fixed intracranial target with submillimeter accuracy; sparing damage to the surrounding tissues and structures of the brain ([Solberg et al., 1998](#); [Ganz, 2011](#)). The stereotactic head frame is attached to the skull with pins (small bolts) that penetrate the skin. After treatment, the head frame is removed, the pin sites are dressed, and postoperative treatment of these pin sites are reviewed with the patient ([Table 1](#)).

GKSR treatment is frequently performed as an outpatient procedure. After treatment, the patient is most often discharged and allowed to resume regular activities the next day. Patients are generally observed via follow-up clinic visits with serial imaging to evaluate the response of their tumor to the treatment. Although the most common patient complaint is fatigue, there are complications related to the technique ([Vachhrajani et al., 2008](#)). Most research on complications related to GKSR procedures addresses radiation necrosis of the brain tissue ([Sanborn et al., 2011](#)) and nonresponse or lack of treatment effect on the tumor ([Patel et al., 2011](#)). Other complications such as localizer and general inflammation are less well studied.

SB is a minimally invasive technique used to obtain diagnostic tissue from an intracranial lesion. A SB is preferred when the risk of mortality and/or damage to adjacent important functional structures is high. A stereotactic frame is attached to the patient who

undergoes imaging such as magnetic resonance imaging or computed tomography (CT) scanning to direct the path of a biopsy needle using the neuroanatomical coordinates obtained from the frame. The major risks related to this procedure are intracranial or intralesional hemorrhage and nondiagnostic tissue recovery. Patients are usually discharged the next day. Patients undergoing this procedure have the same stereotactic head frame placed as those undergoing GKSR. As in the GKSR procedure, this frame holds the head in a locked position allowing for exact targeting of the tissue for biopsy. Before the placement of the head frame for either procedure, the skin is cleansed with a chlorhexidine solution and the patient is given intravenous pain and relaxation medication ([Kramer et al., 2010](#)). The physician injects the pin sites with a lidocaine solution, and the screws are placed and tightened using special bolt drivers set to a specific pressure to eliminate the risk of penetration of the skull. The frame sits snugly and close to the face and head. A stereotactic localizer box is connected to this frame which contains coordinate markers which are entered into the computerized targeting system. Once the frame and localizer box are attached, treatment procedures are initiated. If the patient's hair is in the trajectory of the biopsy, a ½ cm area of hair is shaved at the biopsy probe insertion site.

After treatment or biopsy, the head frame is removed, and pressure is applied to the pin sites with sterile gauze until bleeding is controlled. The sites are then cleansed and covered with an antibiotic ointment. Patients undergoing GKSR treatment have their pin sites covered with bandages and are given instructions on how to care for their screw sites over the next week. Patients undergoing SB are observed overnight in the hospital and undergo a CT scan to assess for any intracerebral hemorrhage related to the procedure. As long as patients are neurologically stable and their CT scans are without significant hemorrhage, they are discharged the next day with pin-site care instructions.

**Table 1. Poststereotactic radiosurgery treatment and poststereotactic biopsy treatment for pin sites**

Steps	Explanation
1.	Remove bandages following day after treatment and leave pin sites open to air. Clean sites twice daily with a mild soap and water. Apply antibiotic ointment twice daily until the sites are healed, which usually takes 5 days.
2.	A small amount of pink drainage on your pillow is not unusual for the first couple of days. The pin sites may be tender to touch for 3-4 days. You may take nonaspirin pain medications such as ibuprofen or acetaminophen if you are having discomfort.
3.	You may wash your hair/scalp 24 hr after your radiosurgery. This gives the pin sites a chance to heal and not introduce infection into the wounds.
4.	Keep your head elevated on a couple of pillows for 1 week. This will help to lessen the swelling at the pin sites and minimize pressure within your head. Apply cold compresses three times a day if swelling occurs, which generally resolves in 5 days.
5.	Notify your doctor of increased pain, redness, swelling, bleeding; the pin sites feel hot to the touch; a cloudy or foul smelling drainage from the pin sites or if Temp is 101°F or higher.
6.	Avoid wearing tight bands or wigs over the pin sites for the next few days. This gives the wounds a chance to heal in a dry, clean environment.

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