Safety and Efficacy of Jet Anesthesia for Bone Marrow Aspirations

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Aspirations or Jamshidi needle biopsies (n = 287) of bone marrow were performed on children and adolescents with acute leukemia or other malignant disease following the use of a spring-loaded instrument that delivered local anesthetic in a jet spray: 89% of the patients were receiving chemotherapy, 12% were thrombocytopenic, and 23% of the 269 patients who were afebrile at the time of the procedure were severely neutropenic. None of these patients had an infection or a hemorrhage as a complication of the procedure. We conclude that not only is this procedure safe, but it is also much less painful than the traditional method of local anesthetic infiltration using a syringe and needle.

OPTIMAL MANAGEMENT of children with acute lymphocytic leukemia (ALL) requires frequent confirmation of continuing remission by "routine" bone marrow aspirations, but these are both painful and frequently dreaded procedures. For the past few years a spring-loaded instrument (Syrijet II; Mizzy, 22 E. 72nd St., New York, N.Y.) that injects local anesthesia as a jet without a needle and with minimal discomfort has been used in dental anesthesia. Although three brief reports on its use for bone marrow aspirations have appeared in the pediatric literature, it is not widely used for this purpose, possibly because of worry about bleeding or infectious episodes resulting from this technique.

We have investigated the complication rate following this form of jet anesthesia in a large number of bone marrow aspirations on leukemic children and in a smaller number of children undergoing a bone marrow biopsy. We hope that this report of its safety in not causing infections or bleeding, as well as its efficacy, will result in the use of this instrument in the practice of hematology.

MATERIALS AND METHODS

From February 1976 to October 1977, 256 bone marrow aspirations using the Syrijet II were performed on 38 children and adolescents ages 1-19 yr (mean 8.2) with ALL. Other forms of analgesia were not used. Of the 256 bone marrow aspirates 18 were performed when the children were febrile; they were excluded from the assessment of secondary infection but were included in the assessment of hemorrhagic complications. The records of all of the children were reviewed to determine if systemic or local infection or local bleeding occurred within 1 wk after the procedure.

At the time of aspirations significant neutropenia (neutrophils fewer than 1.0 x 10^9/liter) was present in 58 of the 238 patients who were afebrile (24%), and thrombocytopenia (platelets fewer than 100.0 x 10^9/liter) was present in 34 of the patients (13%).

The Syrijet II was also used as the only source of anesthesia for 31 bone marrow biopsies performed using the Jamshidi needle. These were done on children and adolescents ages 2-19 yr (mean 13) with solid tumors being evaluated for metastatic disease. Their records were reviewed in the same manner as those of the leukemic patients.
All of the patients who had biopsies were afebrile at the time of the procedure; none had platelet counts less than 100.0 x 10^9/liter, and only three had neutrophil counts less than 1.0 x 10^9/liter.

**Technique.** All aspirations were done on the anterior iliac crest by one of the authors. The area was swabbed twice with two separate cotton swabs containing povidone-iodine solution and then swabbed with 70% isopropyl alcohol. A fourth swab with alcohol was then used to wipe the end of the instrument prior to applying it and used again to swab the puncture site after the anesthetic had been administered. The instrument was adjusted to deliver its maximum amount of solution (0.35 ml of 2% lidocaine delivered with a force of 2600 psi). Its head was applied to the site of the marrow aspiration and pushed firmly onto the skin to get as close to the periosteum as possible, and the jet of anesthetic was then released by a trigger (Fig. 1). The aspiration was performed in the usual manner after waiting 1 min, during which time the operator's hands were gloved.

For patients who underwent a Jamshidi needle bone marrow biopsy a similar procedure was performed, but the posterior iliac spine was used as the puncture site.

Between uses, a cartridge of sterile water was inserted in the instrument to keep the internal path free from contamination. During the days when it was being used, a cartridge of lidocaine was kept in place, but this was changed to a sterile water cartridge after the instrument was used each day. Once a week the instrument was washed with ordinary detergent and then autoclaved.

**RESULTS**

No instances of fever, clinical infection, or local inflammation were reported within the 7 days following either of the bone marrow procedures on afebrile patients. There were no reports of local inflammation at the site of the aspirate or biopsy in any of the patients, nor did clinical hepatitis develop in any of them. There was no bleeding at the site of the procedure in any of these patients.

**COMMENT**

This dental instrument would appear to be both effective and safe in the administration of local anesthesia for bone marrow procedures in children and adolescents. Even though the leukemic children were all receiving immunosuppressant drugs and many of the subjects were significantly neutropenic and/or thrombocytopenic, there were no instances of infection or local hemorrhage. It was apparent to the physicians and nurses working with these patients that this method of anesthesia was much less painful than the infiltrative technique, and without exception those children who had undergone bone marrow aspirations in which the traditional infiltrative method had been used said they preferred this new method.

The fact that we had clinical evidence in all of these aspirations and biopsies...
that the periosteum had been adequately anesthetized was not surprising; animal studies have shown that jet injection of a smaller volume of solution with a lesser force than with our instrument (0.2 ml at 2000 psi) will penetrate 1.5 cm of tissue. None of these children were obese; this technique might not be effective for patients with greater amounts of subcutaneous tissue.

In our experience this instrument is safe, effective, and practically painless in producing local anesthesia. It should be of value to both adult and pediatric hematologists.

REFERENCES

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