Analysis of Tissue Margins of Cone Biopsy Specimens Obtained with “Cold Knife,” CO₂ and Nd:YAG Lasers and a Radiofrequency Surgical Unit

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Analysis of the tissue margins of cone biopsy specimens obtained from 40 patients showed varying degrees of thermal and mechanical artifact at the tissue margins. The least artifact was seen in the tissue margins of specimens obtained with the scalpel (“cold knife”). The amount of thermal damage to biopsies obtained via lasers and the radiofrequency unit varied with the instrument employed. However, the quality of the tissue margins of specimens obtained using a radiofrequency surgical unit equipped with a needle electrode on a “pure cut” setting approached the quality of those obtained with the cold knife in their lack of thermal and mechanical artifact.

Introduction

The outpatient treatment of abnormal cervical cytology has seen many technologic advances in the last decade. The use of lasers for vaporization and cone biopsy and the new electrosurgical devices that provide for loop excision of the abnormal cells have offered safe alternatives to the cone biopsy and the multiple techniques taught for the classic operation. Since cone biopsy was originally described by Lisfranc in 1815, the major complications of hemorrhage, infection and cervical stenosis have concerned clinicians. The difficulty in observing the squamocolumnar junction buried deep in the endocervical canal as a result of sutures for hemostasis has prompted investigators to develop and use better technologies without compromising the principles of safe medical practice.

In recent debates at our institution, the authors have sought to find a safe outpatient technique for evaluating abnormal cervical cytology and dysplasia. The ideal operation involves (1) minimal pain and discomfort, (2) minimal complication rates, especially for hemorrhage and infection, (3) satisfactory tissue margins that allow the pathologist to comment on the adequacy of the excision and (4) minimal capital investment.

Materials and Methods

Over the past four years, the surgeons have evaluated the performance of the CO₂ and Nd:YAG lasers and the radiofrequency surgical unit (Ellman Corporation, Hewlett, New York) for the above criteria. The CO₂ laser was manufactured by Sharplan (Laser Industries, Ltd., Tel Aviv, Israel). The Nd:YAG laser was manufactured by SLT (Malvern, Pennsylvania). As the “gold standard,” the “cold knife” (scalpel) cone was employed because of its outstanding attributes: excellent tissue margins and minimal expense. The specimens from 20 cold knife conizations, 11 CO₂ laser cone biopsies, 3 cone biopsies performed with

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0024-7758/92/3707-0607/$1.50/0 © The Journal of Reproductive Medicine, Inc.
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the SLT laser, and 6 cone biopsies by radiofrequency excision (3 with a needle electrode and 3 with a loop device) were examined for adequacy of tissue margins. In those cases in which the cone biopsy was obtained by the loop excision technique, the actual time required for the loop excision to be performed was less than 10 seconds. The ongoing concern expressed by the study team pathologist was that the ideal specimen should not have any mechanical and/or thermal artifact that would interfere with interpretation of the involvement of the tissue margins with dysplasia or cancer.

Patients requesting treatment in the ambulatory surgery center were usually given light inhalation anesthesia and supplemental intravenous sedation. A paracervical block of 1% lidocaine was frequently used alone or with the inhalation agents. To achieve hemostasis, pitressin was administered in accordance with the guidelines of Harper et al., who described cardiovascular changes as common when less than 1 unit of pitressin was administered. Harper showed that 0.5–0.75 units gave satisfactory hemo-
stasis when the pitressin solution was injected submucosally. In our study the solution was mixed by the surgeon to give 1 unit of pitressin per 5 mL of normal saline.

Results
This investigation was designed to evaluate the strengths and weaknesses of the four methods and to determine whether the newly available radiofrequency surgical unit would fulfill the criteria for safety, low complication rate, patient acceptance, satisfactory tissue margins and minimal expense. The least thermal and mechanical damage is seen in the cold knife specimens which are therefore best for tissue analysis. One does not have the problem of having the dysplastic process running into the edge of the specimen that has been obliterated by coagulation necrosis or carbon char (Figure 1).

When using the radiofrequency unit, which employs both a loop and a needle electrode, the pathologist notes the occasional detachment of the epithelium from the underlying stroma (Figure 2). Another occasional finding with the loop electrode is polarization of the nuclei of the endocervical glands and distention and distortion of the endocervical glands (Figure 3). In extreme cases in which the electrode is moved through the tissue in a very slow fashion, one may see coagulation necrosis at the tissue margin. The needle electrode used on a pure cut at a setting of about “4” does not show this artifact. In fact the tissue margins shown in Figure 4 are almost indistinguishable from those obtained with the cold knife. In Figure 5, the endocervical margin shows no significant tissue distortion or coagulation. Use of the scalpel attachment on the SLT (Figure 6) produced a specimen with significant thermal artifact. The CO₂ laser used to obtain the specimen in Figure 7 also shows significant char and artifact.

Discussion
We believe that we have demonstrated the efficacy of the radiofrequency unit for cone biopsies. The surgeon must understand the instruments' effect on the
tissue and therefore must match the tissue effects to
the requirements of the pathophysiologic principles
of the disease being treated. If the surgeon is able to
obtain a sufficiently wide margin of normal tissue
between the dysplasia on the cervix and the surgical
tissue margins, mechanical distortion, coagulation
necrosis or char will not interfere with the patholo-
gist’s interpretation.

The cost efficiency of the radiofrequency unit we
have used is exceptional—as much as 10–40 times
that of lasers. Speed and ease of performance are
definite advantages of the loop excision technique
with the radiofrequency surgical unit.

With the radiofrequency unit, one does not need a
ground return pad. The unit uses an antenna which
acts as a return electrode and should be placed under
the operative field. This surgical unit operates at 3.8
MHz as opposed to the 0.5–1 MHz range of other
electrosurgical units. Its effect on tissue is that of
dissecting an envelope of steam around the electrode
as it passes rapidly through the tissue. Tissues with
higher water content are dissected more easily than
those with less water content. This accounts for the
favorable experience when used on the cervix.

Conclusion

When cone biopsy specimens were obtained with the
radiofrequency surgical unit at a pure cut setting of 4
and with pitressin as a hemostatic agent, the resul-
tant tissue margins’ lack of artifact and thermal dam-
age was comparable to those of cone biopsies ob-
tained by the cold knife in the hands of an experi-
enced surgeon. We recommend the radiofrequency
surgical unit for outpatient use in obtaining cone
biopsies on the basis of the acceptability of its tissue
effects, its inexpensive technology and its inherent
safety.

References


Figure 8
Clinical set-up of Surgitron and Vapour-Vac on SurgiCart.