



## Original Article

# Radiofrequency Pilonidal Sinus Excision: Better Option to Wide Excision and Open Wound Healing Technique

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## Abstract

**Aim:** Evaluation of outcome of pilonidal sinus excision using a radiofrequency device and comparing its results with wide excision and open granulation procedure.

**Methods:** Patients with sacro-coccygeal pilonidal sinus disease (n=44) were randomly assigned to undergo either a wide excision and healing by open granulation procedure [WEG] (n=23) or a radiofrequency sinus excision [RSE] (n=21). A Ellman radiofrequency generator was used for sinus excision. Peri and postoperative events, complexity and outcome data were recorded and analyzed by student's unpaired t-test with 95% confidence interval. (95%CI)

**Results:** The significant differences in the two group WEG and RSE were as follows- mean hospital stay [47 vs. 10 hours,  $p < 0.001$ ], period off work [29 vs. 8 days,  $p < 0.001$ ], mean analgesic requirement [39 vs. 15 tablets,  $p < 0.001$ ], time for complete wound healing [84 vs. 49 days,  $p < 0.001$ ]. At the mean follow-up of 30 months, two patients from the wide excision and open granulation group and one patient from the radiofrequency sinus excision group developed recurrence.

**Conclusion:** These findings suggest that sinus excision with radiofrequency is a simple and swift procedure. It needs a short hospital stay and is associated with less postoperative pain and early resumption to work. As compared to excision and healing by granulation technique, the radiofrequency sinus excision procedure achieves faster wound healing and a better outcome.

**Keywords:** Pilonidal sinus. Excision and open wound Radiofrequency. Recurrence.

## Introduction

Pilonidal sinus disease consists of complex symptoms with presentations ranging from asymptomatic pits to painful draining lesions that are predominantly located in the sacro-coccygeal region. Non-operative measures like simple shaving or injection of phenol in the tract

(Phenolization)<sup>(1)</sup> may control symptoms without surgical intervention in a self-limiting disease. However, a high recurrence and failure rate of as much as 30% has been reported with such approaches<sup>(2)</sup>.

Radical excision has still been the most widely practiced surgical procedure for the treatment of

pilonidal disease<sup>(3,4)</sup>. The entire sinus is excised with surrounding tissue down to the post sacral fascia. The defect may be left open to granulate, or is closed by primary suturing or with some form of flap. Partial closure by marsupialization is another option<sup>(5)</sup>. Excision with primary closure reduces the healing time, but wound infections and recurrence rates are generally high<sup>(6)</sup>. To obviate these problems more complex procedures like closure by Z-plasty, asymmetric flap, rhomboid or myocutaneous advancement flaps have been advocated<sup>(7)</sup>. These have succeeded in reducing the recurrence rate, but they need expertise, require longer operative periods and postoperative hospital stay<sup>(8)</sup>.

Wide excision and healing by open granulation is favored by many surgeons due to simplicity of the procedure and the low rate of recurrence<sup>(9)</sup>. However, healing by secondary intention takes longer period and needs regular dressing and meticulous wound care with control of hair growth by shaving the natal cleft regularly<sup>(10)</sup>.

Lord and Millar<sup>(11)</sup> described excision of midline epithelial follicles under local anesthesia followed by brushing of the tract to remove hairs within the granulation lined tract. A 'lay open' method is another minimally invasive technique which can be done on outpatient basis and having a low recurrence rate<sup>(12)</sup>. It however, is associated with slow healing.

While following Lord and Millar's technique, we modified their procedure by excision of the complete tract instead of brushing it, and left the wound open for healing by secondary intention. A radiofrequency device was used to carry out the complete procedure.

The aim of this paper is to describe the technique of radiofrequency sinus excision, and to compare it with the outcome of wide excision and healing by granulation procedure.

**Radiofrequency surgery-** Radiofrequency surgery is a method of achieving simultaneous cutting and coagulation of the tissue using a wave frequency that is used for radio broadcasting. The alternating current passes down from an uninsulated electrode

tip of the radiofrequency device to the targeted tissue and generates changes in the direction of ions within the tissue fluid. The tissue is heated by electric resistive heating. The water so heated in the tissue gets vaporized when the temperature reaches 100<sup>0</sup> C. However, as the temperature is kept under control at 100<sup>0</sup> C, it causes little charring and carbonization<sup>(13)</sup>. This facilitates tissue sectioning with minimal lateral thermal damage. This vaporization also results in significant hemostasis<sup>(14)</sup>.

A Ellman dual frequency radiofrequency generator [Ellman International, Oceanside, N.Y, USA] was used for this purpose. This instrument produces an electromagnetic wave having a frequency of 4 MHz, which is considered as the ideal radiofrequency. The unit is supplied with a handle to which different electrodes could be attached to suit the requirement of the surgical procedure. For the procedure of sinus excision, we used a needle electrode to incise the tract, a loop electrode to reshape the wound edges and a ball electrode to coagulate the bleeding points.

## Subjects and Methods

### Subjects

This study was carried out at Procto Clinic Sai Suman Hospital, Solapur, Maharashtra, India between July 2012 and December 2013, with a follow up that continued until December 2016. The study was approved by the national ethical committee and was performed according to the Declaration of Helsinki. Informed consent was obtained from all the patients.

44 patients with chronic sacro-coccygeal pilonidal sinus disease were randomized into two groups A and B. Patients from group A were operated by wide excision and open granulation [WEG] technique and those from Group B underwent radiofrequency sinus excision [RSE]. Randomization was done by sealed envelop which was opened by the operation room nurse on patient's arrival in the operation room.

**Inclusion criteria-** Patients who had actively draining sinuses were only considered for this

study. Patients presenting with acute abscess and those who were previously operated for this pathology were excluded.

### Methods

The same surgeon performed both the procedures under a short-term general anesthesia.

Wide excision and open granulation procedure- With the patient lying in left lateral position, his buttocks were positioned to project them beyond the edge of the table. The uppermost buttock was elevated by firm traction of fingers of both the hands by the assistant making the internal skin tense and making incision easier.

Methylene blue was instilled in one of the sinus. An elliptical incision, which included all the sinuses, was deepened down through the fat to reach the post sacral fascia. While applying traction, this elliptical part containing skin, fat and the sinus tract was separated from the underlying fascia. The brisk bleeding encountered was secured and the wound edges were trimmed. If a sinus was noticed on the lateral aspect of the main tract, it was incorporated in the same incision as a special offshoot, to leave behind no area that looked blue in color. The wound was secured by an elastic supportive dressing.

### Radiofrequency sinus excision procedure-

The procedure was performed making the patient lie in a left lateral position. The sinus openings were identified and methylene blue mixed with hydrogen peroxide was instilled in one of the sinuses. This maneuver, while delineating the sinus tract and its branches, also helped in removing blockages created by cell debris and granulation thus facilitating opening of the tracts<sup>(15)</sup>. A director probe was then inserted in the sinus opening and using the fine needle electrode the skin and subcutaneous tissue were incised encircling the sinus opening with a margin of at least 1centemeters around it. Any brisk bleeding encountered was coagulated with the ball electrode. A funnel shaped dissection continued until the inner end of the sinus tract was reached. No attempt was made to deepen the incision to the

post-sacral fascia. The tracts could be easily recognized as a rigid, blue tissue. If the sinuses were found connected with each other, the fistula tract and the skin between the two sinuses were simultaneously excised. All the tracts were traced and removed in the similar way, which obviated the need to brush or curette the remaining tissues. The edges of the wound finally created were reshaped with the round loop electrode to create a wound having a shape of an inverted cone i.e., widest externally and narrowest internally. The wound was secured with an adhesive dressing. Figure 1

The operative time was calculated from the time the incision was given and ending with completion of the procedure i.e., application of dressing.

### Postoperative care-

Patients were encouraged to mobilize immediately after surgery. No antibiotics were prescribed. Patients were asked to take a tablet containing 10mg of Serratiopeptidase and 50mg of Diclofenac sodium [Tab Emanzen D, Emcure Pharma, India] to be consumed twice in a day till they felt pain. The patients were sounded to opt either to continue hospitalization or be discharged if feeling fully comfortable on every evening at 6 PM. After discharge, the patients were asked to wash the wound twice a day with soap and warm water and to apply a protective dressing over the wound. Patients were called in the office every alternate day or earlier if needed.

Both the groups were evaluated in terms of demographics, symptoms before procedure, operative time and postoperative complications like wound infection, delayed wound healing, and pain. An independent observer assessed the period of hospitalization, number of wound dressings performed in the office, time for complete wound healing and recurrence. This follow-up was continued till the wound healed completely. Thereafter, the patients were asked to report after at least 30 months of the procedure.

**Statistical Analysis-** The results are presented as means and standard deviation. Initial power

calculations suggested that a minimum of 16 patients were required in each group to detect a difference of one standard deviation in operation time and period of hospitalization, with an 80 percent power at a 5% significance level. Data was entered in to a database and analyzed using statistical software (Graph pad quick Calc, San Diego, CA). An unpaired student's t- test was used for evaluation and a p value of <0.05 was considered statistically significant.

### Results

A total of 44 patients with chronic pilonidal disease were randomly assigned to undergo either a wide excision and open granulation procedure (WEG group) [n=23] or a radiofrequency sinus excision (RSE group) [n=21]. There was no significant difference between gender, age or presenting symptoms in both the groups. [Table 1]

The operative time was significantly shorter in radiofrequency group in comparison to the WEG group (10 vs. 27 minutes,  $p < 0.001$ ). Patients from control group required a longer hospitalization period (47 vs. 10 hrs,  $p < 0.001$ ) when compared with radiofrequency sinus excision group.

The duration of postoperative pain was longer in WEG group when compared with the patients from the sinus excision group. Consequently, the patients from control group needed more than

double the dose of analgesics than the patients operated by radiofrequency technique. (39 vs. 15 tablets,  $p < 0.001$ )

Patients from radiofrequency sinus excision group were able to resume their daily activities quite earlier than the patients from the WEG group (8 versus 29 days,  $p < 0.001$ ).

Two patients from the WEG group developed suppurative infection in the wounds in the 3<sup>rd</sup> week of the procedure. The wounds were irrigated and the discharge was cultured to prescribe appropriate antibiotics. While one wound uneventfully healed thereafter, another continued to remain unhealed with frequent discharge and braking of the overlying skin. No such wound related complications were noticed with the radiofrequency sinus excision group.

The wounds undergoing wide excision and open granulation took much longer period to heal when compared with the wounds of radiofrequency sinus excision. (84 vs. 49 days,  $p < 0.001$ ).

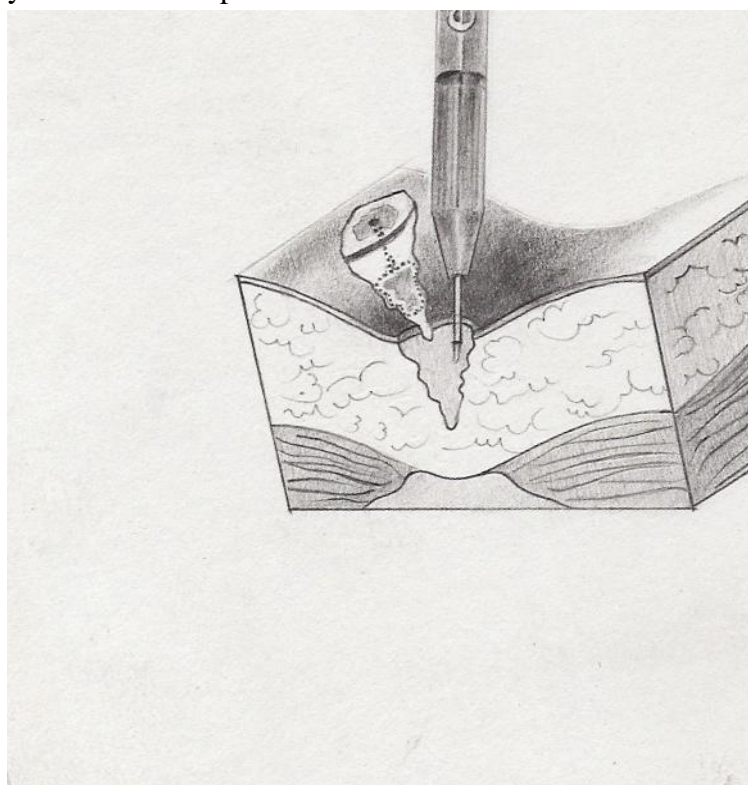
The follow-up periods were identical in both the groups. Two patients from the WEG group and one patient from the radiofrequency sinus excision group failed to attend the office at 30 months postoperative follow-up. One patient from the radiofrequency sinus excision group and two patients from the control group developed recurrence during this period. [Table 2]

**Table 1-** Patient demographics and pre-treatment symptoms

	Radiofrequency sinus excision (n=21)	Wide excision and healing by open granulation (n=23)
Age (mean) {SD}, years	22.20{3.4}	23.10 {2.9}
Male: Female	16:5	17:6
Symptoms (number of patients)		
Discharge	20	21
Pain	18	17
Itching	11	11
Bleeding	2	1

**Table 2-** Comparative findings of the postoperative events between wide excision and open granulation and radiofrequency sinus excision technique

	Wide excision and healing by open granulation	Radiofrequency sinus excision	p*
Operation time in minutes.	27 (4.1)	10 (3.3)	<0.001
Hospitalization in hrs.	47 (5)	10 (4)	<0.001
Period off work in days.	29(3.7)	8 (1.3)	<0.001
Number of analgesic tablets consumed	39 (4.3)	15(5.5)	<0.001
Wound infection (n)	2	0	NS
Wound dressing			
In hospital	39 (6)	13(3)	<0.001
Wound healing period (days)	84 (14)	49(8)	<0.001
Recurrence (n)	2	1	NS
Values are mean (S.D)	NS – not significant		
* student's unpaired t-test 95% confidential interval			

**Figure 1-** Radiofrequency sinus excision procedure**Discussion**

Various methods are being tried to tackle pilonidal sinus disease but no one method came to be accepted universally. Recurrences vary with the technique, operator and length of follow-up<sup>(16)</sup>. An ideal surgical procedure should be one that could be performed as a day care or on outpatient

basis. It should be simple to perform, should have a low recurrence rate coupled with a rapid and complete wound healing. It should have minimal after care requirements such as shaving or dressing<sup>(17)</sup>.

Many studies have concluded that simpler treatment methods for pilonidal disease carry less

morbidity and a low recurrence rate<sup>(18,19,20)</sup>. As the procedure of sinus excision by radiofrequency aims at removal of the sinuses alone while causing little damage to the surrounding healthy tissues, it can be termed as a simple and minimally invasive technique.

Contrary to Lord and Millar's technique, radiofrequency sinus excision takes a wider skin incision and creates a funnel shaped wound with removal of the overlying skin. With this maneuver, there is hardly any chance of leaving behind any inflammatory tissue or part of the sinus tract behind. This also prevents forming a dead space under the skin in the early postoperative period, particularly when the buttocks come closer.

When compared, sinus excision by radiofrequency offers several advantages over the more extensive wide excision and healing by open granulation procedure.

The operative time for radiofrequency sinus excision was significantly shorter when compared with the WEG technique. This was possible because while excising the sinus and the offending tissues, the electrode of the device provides a coagulative effect obviating the need to secure bleeding points<sup>(21)</sup>.

Radiofrequency has been shown to achieve sealing of the sensory nerve endings and the leaking lymphatics<sup>(22)</sup>, the two factors, which are supposed to cause postoperative pain<sup>(23, 24, 25)</sup>. As a large wound is created after wide excision, the wound and its edges become a source of constant pain. Due to minimal pain and insignificant discomfort, the patients operated with radiofrequency needed lesser quantity of analgesics<sup>(26)</sup>.

While patients operated with radiofrequency procedure were able to return home within 12 hours of the procedure, the mean duration of hospital stay in the control group was significantly longer. The patients operated by wide excision and open granulation preferred to stay in the hospital due to pain, a large wound and need for dressing under supervision of a nurse<sup>(27, 28)</sup>.

The patients operated by radiofrequency technique were able to join their duties much earlier than the patients operated by wide excision and open granulation method (8 days versus 29 days). Negligible pain, comfort in performing routine activity and absence of specific wound care encouraged the patients from the radiofrequency sinus excision group to resume duties early<sup>(29)</sup>.

Apart from conventional scalpel dissection, few other devices have been used in the surgery of pilonidal sinus disease. Shafik<sup>(30)</sup> used electrocautery for sinus excision and found it to be an easy and convenient method. The high frequency radio waves has a property of sealing small blood vessels while dissecting the tissues without creating any char, whereas the cautery or electrosurgical instruments create heat at the tip of the instruments, which is transferred to the tissues creating a temperature far exceeding the therapeutic need<sup>(31,32,33)</sup>. This invariably results in burning of the adjacent healthy tissues and cause more pain and delay in wound healing<sup>(34)</sup>.

Nd: YAG<sup>(35)</sup> and Ruby lasers<sup>(36)</sup> have also been used in the surgery of pilonidal sinus disease and have reported to reduce pain and length of hospitalization with early return to work. The radiofrequency also works in a manner similar to the laser minus its attending disadvantages like the risk of misdirected reflected beams and prolonged wound healing period<sup>(37,38)</sup>. Noteworthy is the fact that the cost of treatment with lasers is very high.

Different malleable electrodes are available with the radiofrequency device that could be selected to suit the requirements of sinus excision like incision, shaping of the wound edges and coagulation of bleeding points<sup>(39)</sup>.

The wounds created with radiofrequency healed significantly faster than the wide excision group. This was possible due to a significantly small wound created by radiofrequency with a minimum lateral damage. This was evident with a significantly lesser need to change the dressing of wounds in the hospital. Similarly, wound related complications like secondary infection and non-

healing was not observed with radiofrequency procedure.

Open surgical treatment of pilonidal sinus is reported to have a very high percentage of complete wound healing<sup>(3,9,40)</sup>. However, in our study, failure of wound healing and recurrence (13%) with this procedure were noticed. A 30-month follow up of the patients seems to be adequate to evaluate the efficacy and outcome of the procedure<sup>(41,42)</sup>.

While the radiofrequency sinus excision procedure can be performed as a day care surgery, longer duration of hospital stay and greater consumption of inpatient hospital resources associated with the wide local excision and open granulation technique, are other factors which should be taken into consideration while opting either of the two surgical procedures for pilonidal sinus disease.

In conclusion, radiofrequency sinus excision technique has definite advantage over wide excision and open granulation technique in dealing with a symptomatic, chronic pilonidal disease.

It is however admitted that this study of 44 patients is too small to permit final conclusions to be drawn concerning significant advantages of one form of treatment over the other. It is, nonetheless felt that there is a future for this technique either as a primary treatment or as an adjunct to surgery in refractive cases of symptomatic pilonidal sinus disease.

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#### References

1. Dogru O, Camci C, Aygen E, Girgin M, Topuz O. Pilonidal sinus treated with crystallized phenol: an eight-year experience. *Dis Colon Rectum* 2004; 47:1934-1938.
2. Duchateau J, De Mol J, Bostoen H, Allegaert W. Pilonidal sinus. Excision--marsupialization--phenolization? *Acta Chir Belg.* 1985; 85: 325-328.
3. Fuzun M, Bakir H, Soyulu M, Tansug T, Kaymak E, Harmancioglu O. Which technique for treatment of pilonidal sinus--open or closed? *Dis Colon Rectum* 1994; 37: 1148-1150.
4. Sondena K, Nesvik I, Andersen E, Soreide JA. Recurrent pilonidal sinus after excision with closed or open treatment: final result of a randomised trial. *Eur J Surg.* 1996; 162: 237-240.
5. Spivak H, Brooks VL, Nussbaum M, Friedman I. Treatment of chronic pilonidal disease. *Dis Colon Rectum* 1996; 39: 1136-1139.
6. Iesalnieks I, Furst A, Rentsch M, Kaich KW. Primary midline closure after excision of pilonidal sinus is associated with a high recurrence rate. *Chirurg.* 2003; 74:461-468.
7. Chintapatla S, Safarani N, Kumar S, Haboubi N. Sacrococcygeal pilonidal sinus: historical review, pathological insight and surgical options. *Tech Coloproctol.* 2003; 7:3-8.
8. Lee HC, Ho YH, Seow CF, Eu KW, Nyam D. Pilonidal disease in Singapore: clinical features and management. *Aust N Z J Surg.* 2000; 70: 196-198.
9. Blanco G, Giordano M, Torelli I. Surgical treatment of pilonidal sinus with open surgical technique. *Minerva Chir.* 2003; 58:181-187.
10. Chiedozi LC, Al-Rayyes FA, Salem MM, Al-Haddi FH, Al-Bidewi AA. Management of pilonidal sinus. *Saudi Med J* 2002; 23: 786-788.
11. Lord PH, Millar DM. Pilonidal sinus: a simple treatment. *Br J Surg.* 1965; 52:298-300.
12. Al-Homoud SJ, Habib ZS, Abdul Jabbar AS, Isbister WH. 2001. Management of sacrococcygeal pilonidal disease. *Saudi Med J* 2001; 22: 762-764.

13. Huang SK. Advances in applications of radiofrequency current to catheter ablation therapy. *Pacing Clin Electrophysiol.*1991; 14: 28-42.
14. Goldberg SN, Gazelle GS. Radiofrequency tissue ablation: Physical principles and techniques for increasing coagulation necrosis- *Hepatogastroenterology* 2001; 48: 359-367.
15. Gunawardhana PA, Deen KI. Comparison of hydrogen peroxide instillation with Goodsall's rule for fistula-in-ano. *ANZ J Surg.* 2001; 71: 472-474.
16. Hull TL, Wu J. Pilonidal disease. *Surg Clin North Am.* 2002; 82: 1169-1185
17. Destito C, Romagnoli A, Pucello D, Mercuri M, Marin AW. Pilonidal sinus: long term results of excision and closure technic. Review of the literature. *G Chir.* 1997; 18: 441-446.
18. Zieger K. Complications after surgery for pilonidal cyst. An introduction to a new debate on a "costly" disease. *Ugeskr Laeger* 1999; 161: 6056-6058.
19. Petersen S, Koch R, Stelzner S, Wendlandt TP, Ludwig K. Primary closure techniques in chronic pilonidal sinus: a survey of the results of different surgical approaches. *Dis Colon Rectum* 2002; 45: 1458-1467.
20. Meban S, Hunter E. Outpatient treatment of pilonidal disease. *Can Med Assoc J* 1982; 126: 941.
21. Goldberg SN, Gazelle GS, Dawson SL, Rittman WJ, Mueller PR, Rosenthal DI. Tissue ablation with radiofrequency: effect of probe size, gauge, duration and temperature on lesion volume. *Acad Radiol.* 1995; 2: 399-404.
22. Niamtu J. Oral and Maxillofacial surgical clinics of North America. *Cosmetic facial surgery* 2000; 12:771-780.
23. Hussain SA, Hussain S. Incisions with knife or diathermy and postoperative pain. *Br J Surg.* 1988; 75:1179-1180.
24. Friedman M, Mikityansky I, Kam A, Libutti SK, Walther MM, Neeman Z et al. Radiofrequency ablation of cancer. *Cardiovasc Intervent Radiol.* 2004; 27:427-434.
25. Filingeri V, Gravante G, Baldessari E, Casciani CU. Radiofrequency fistulectomy vs. diathermic fistulotomy for submucosal fistulas: a randomized trial. *Eur Rev Med Pharmacol Sci.* 2004; 8:111-116.
26. Masala S, Roselli M, Massari F, Fiori R, Ursone A, Fossile E et al. Radiofrequency Heat Ablation and Vertebroplasty in the treatment of neoplastic vertebral body fractures. *Anticancer Res.* 2004; 24: 3129-3133.
27. Hurst DW. The evolution of management of pilonidal sinus disease. *Can J Surg.* 1984; 27: 603-605.
28. da Silva JH. Pilonidal cyst: cause and treatment. *Dis Colon Rectum* 2000; 43: 1146-1156.
29. Isbister WH, Prasad J. Pilonidal disease. *Aust N Z J Surg.* 1995; 65: 561-563.
30. Shafik A. Electrocauterization in the treatment of pilonidal sinus. *Int Surg.* 1996; 81: 83-84.
31. Filingeri V, Gravante G, Baldessari E, Craboledda P, Bellati F, Casciani CU. A randomised trial comparing submucosal haemorrhoidectomy with radiofrequency bistoury vs. diathermic haemorrhoidectomy. *Eur Rev Med Pharmacol Sci.* 2004; 8:79-85.
32. Oyake D, Ochi K, Takatsu M, Shintani T, Umehara T, Koizuka I. Clinical effect of bipolar radiofrequency thermotherapy on allergic rhinitis. *Nippon Jibiinkoka Gakkai Kaiho.* 2004; 107: 695-701.
33. Oshima F, Yamakado K, Akeboshi M, Takaki H, Nakatsuka A, Makita M et al. Lung radiofrequency ablation with and without bronchial occlusion: experimental study in porcine lungs. *J Vasc Interv Radiol.* 2004; 15:1451-1456.



34. Terk AR, Levine SB. Radiofrequency volume tissue reduction of the tonsils: case report and histopathologic findings. *Ear Nose Throat J* 2004; 83: 572, 574.
35. Palesty JA, Zahir KS, Dudrick SJ, Ferri S, Tripodi G. Nd: YAG laser surgery for the excision of pilonidal cysts: a comparison with traditional techniques. *Lasers Surg.* 2000; 26: 380-385.
36. Lavelle M, Jafri Z, Town G. Recurrent pilonidal sinus treated with epilation using a ruby laser. *J Cosmet Laser Ther.* 2002; 4: 45-47.
37. Brown J.S. Radiosurgery. In *Minor Surgery- A Text and Atlas.* 3<sup>rd</sup> edition; London. Chapman and Hall: 1997.
38. Pfenninger JL, DeWitt DE. Radio frequency surgery. In Pfenninger JL, Fowler GC editors. *Procedures for primary care physicians.* St.Louis: Mosby; 1994. p 91-101.
39. Kainz C, Tempfer C, Sliutz G, Breitenecker G, Reinthaller A. Radiosurgery in the management of cervical intraepithelial neoplasia. *J Reprod Med.* 1996; 41:409-414.
40. Breuninger H. Treatment of pilonidal sinus and acne inversa. *Hautarzt* 2004; 55: 254-258.
41. Miocinovic M, Horzic M, Bunoza D. The treatment of pilonidal disease of the sacrococcygeal region by the method of limited excision and open wound healing. *Acta Med Croatica* 2000; 54: 27-31.
42. Menzel T, Dorner A, Cramer J. Excision and open wound treatment of pilonidal sinus. Rate of recurrence and duration of work incapacity. *Dtsch Med Wochenschr.* 1997; 122: 1447-1451.