

Management of Perianal Defects of Various Etiologies

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ABSTRACT

Reconstruction at the perianal region is difficult because the area is contaminated and any tension in closure will end up with disruption at the suture line or ectropion and dysfunction of the anus. The reconstruction is better done by flaps and closure should be tension free. The literature discussed the management of specific perianal lesions separately but to our knowledge no single article discussed the management of perianal defects of various etiologies in the same article. This study included 16 patients who needed reconstruction of perianal defects resulted from necrotizing fasciitis, hidradenitis suppurativa, lymphangioma circumscriptum, diathermy burn and sacrococcygeal pressure sores. Reconstruction was by direct closure, split-thickness skin grafts or flaps. Perianal skin grafts showed 30% loss while flaps survived completely except for the skin paddle of a gracilis myocutaneous flap. Partial disruption at the flap suture line in two cases was left to heal by 2ry intention. The area of loss of skin paddle over the gracilis muscle was left to heal too by 2ry intention. Recurrence of hidradenitis suppurative occurred in one patient twice and repeated surgeries were done. There was no need to do colostomy in any of our patients. Conclusion is that reconstruction of perianal defects is better conducted by local flaps but other methods like skin grafts and closure with 2ry intention are acceptable.

INTRODUCTION

Reconstruction of a large perianal defects is challenging because closure should be tension-free. Any tension will cause dehiscence between the flaps and the anal mucosa because the anal mucosa is a fragile tissue and cannot support any tension. Tension may in addition cause anal ectropion and dysfunction [1].

Anorectal region is always contaminated due to the proximity of anus and presence of feces which elevates the risk of wound infection [2].

Perianal lesions include necrotizing fasciitis, [1,3] hidradenitis suppurativa, [4-8] condyloma acuminatum, [2,9-11] extramammary Paget's disease

[12-14] Bowen disease [12,15] or, Squamous cell carcinoma [16,17]. Rarely pressure sores especially sacral pressure sores extend to the anus.

Options for reconstruction range from leaving the defect to healing by secondary intention or direct closure [18-22] in cases of small defects. Large defects need skin grafts, [19,22-31] local, regional or free vascularized flaps [5,16,32-43].

The main disadvantage of the skin grafts is that they do not provide enough cushion on the perianal area and it takes a long time for the patient to return to normal daily life [44]. The grafted skin tends to become infected by bacteria followed by graft necrosis [37]. Another cause of poor healing of skin grafts is the frequent urinary and fecal contamination causing skin maceration and breakdown [45]. Donor site morbidity after harvesting split thickness skin grafts should be considered.

These disadvantages of skin grafts make the use of flaps for reconstruction is preferable. The use of single large flap for coverage of a large perianal defects necessitates extensive soft tissue dissection and manipulation. In addition, it is difficult to cover large perianal defects with no tension if single flap was used. The use of multiple flaps is more appropriate [1].

Although flaps described for reconstruction of defects of the gluteal region have advantages compared with skin grafts, limitations in terms of design and size of flaps are the faced difficulties [37]. Elevations of flaps of long pedicles like the superior and inferior gluteal artery perforator flaps enable healthy tissue mobilization up to 12cm in distance thus, prevent the aforementioned restrictions [36,44,46]. Designs of hatchet type II flaps allowed more distant excursion of flaps [47].

An important advantage of reconstruction of perianal region with flap surgery is the early mobilization, short hospital stay and the ability of taking shower earlier than in case of skin grafting [44].

Up to our knowledge at least in the English language literature no previous published articles discussed the management of perianal defects of various etiologies in the same article. The aim of this work is to present our experience in management of perianal defects of various etiologies and to review the literature.

MATERIAL AND METHODS

Sixteen patients were included in this study between February 2006 and February 2012. The study was performed at Ain Shams University hospitals. The study was approved by the ethical committee. All patients signed consents for photographing the lesions and to be included in the study. Two were females and the remaining were males. Both females had hidradenitis suppurativa. The youngest patient was 8 years old and the oldest patients were 66 year old. The data of the patients are shown in Table (1). One of the patients was operated upon three times over 4 year period due to recurrence of hidradenitis suppurativa. Therefore the total number of surgeries was 18.

Surgeries were performed under endotracheal general anaesthesia except the cases with pressure necrosis due to paraplegia no anesthesia was needed. The anesthesiologists monitored all patients including those who did not need anesthesia.

A mechanical bowel preparation and prophylactic antibiotics were used preoperatively. Blood transfusion was administered intraoperatively for all but one of the patient. This patient who did not need blood transfusion is the one with the small perineal pressure sore.

The study included 7 cases of hidradenitis suppurativa, 2 cases of necrotizing fasciitis, 4 cases of sacrococcygeal and one case of perineal pressure sores, 1 case of diathermy burn and 1 case of lymphangioma circumscriptum.

Excision of the lesions whether hidradenitis suppurativa, necrotizing fasciitis, diathermy burn or lymphangioma circumscriptum was done by the general surgery author who has extensive experience in anal surgeries. He was responsible for excision of the lesion with preservation of the anal sphincter. Fig. (1) shows a photo for a case of perianal hidradenitis suppurativa.

All excisions and reconstructions were performed in the lithotomy and the prone jackknife positions according to the extension of the lesions and the plane for reconstruction. Change in position of the patient intraoperatively was needed in two cases. The defects were circum-anal (doughnut-shaped) in 3 cases and were non circumfrential in the remaining cases. Immediate reconstruction after excision was the role except in the cases of necrotizing fasciitis.

The plan for reconstruction was left till complete excision of the defect to avoid any bias that may result in under excision. Neither temporary nor permanent colostomy was needed in any of the patients.

Excision of the bursae in case of the pressure sores and reconstruction of all cases was performed by the plastic surgery author. Direct closure technique was used in 3 cases for very small defects after excision of hidradenitis suppurativa. Skin graft alone was used in one case. A combination of skin flaps and skin grafts was done in two cases. Part of the defect was intentionally left to heal by 2ry intension after partial reconstruction of the defect by two flaps in one case. Single flaps used in 3 cases and more than one flap were used together in the remaining cases managed by flaps.

The flaps used for reconstruction were V-Y sliding flaps based on superior and inferior gluteal arteries perforators in cases of flaps from the gluteal regions and on the profunda femoris artery perforators in cases of the flaps from the posterior thigh. Hatchet type I flap was used for perineal pressure sore and hatchet type II flaps were used for reconstruction of the srotum and perineum in cases of necrotizing fasciitis. Hatchet type II flap was also used to cover the donor side of the transposition flap that has been used to cover the defect after excision of lymphangioma circumscriptum. Gracilis myocutaneous flap was used to cover the defect left after excision of perianal hidradenitis suppurative in one patient.

To avoid tensions between the flaps and anal mucosa the flaps advanced from the opposite directions are sutured to each others in cases of circum-anal defects and the advanced flap is sutured to the opposite side skin in cases of non-circumfrential defects. The contact between the flaps and anal mucosa is sutured with no tension. Suction drains were applied underneath all flaps except in the case where small uncovered area was left for healing by 2ry intension. All external sutures were mono-filamentous to be able to keep them for one month without being afraid of infection.

Table (1): Data of the patients.

Patient number	Age (ys)	Gender	Lesion	Duration of lesion	Defect after excision	Flap	Postoperative complications	Followup period
1	59	Male	Diathermy burn	2 ms	Sacro-coccygeal, perianal	V-Y sliding flap	None	3 months
2	48	Male	Necrotizing fasciitis	2 ms	Groin, scrotum, perineum, perianal	V-Y sliding flap, direct closure, hatchet flap (type II)	None	3 months
3	24	Female	Hidradenitis suppurativa	12 ms	Sacro-coccygeal, perianal	Hatchet flap (type I) and two V-Y sliding flap	Disruption of perianal sutures	9 months
4	8	Male	Lymphangioma circumscriptum	6 ms	Perianal	Transposition flap and hatchet flap (type II)	Hypertrophic scars	5 months
5a	44	Male	Hidradenitis suppurativa	6 ms	Perianal	2 island flaps based on profunda femoris perforators and skin grafts	Disruption between one of the flaps and the anus	4 years
5b	44	Male	Hidradenitis suppurativa	5 ms	Scrotum, perineum and perianal	2 hatchet flaps (type II) from both thighs for scrotum and the perineum was left for healing by 2ry intention	None	2.5 years
5c	44	Male	Hidradenitis suppurativa	8 ms	Sacro-coccygeal, perianal	V-Y sliding flap and hatchet flap (type I)	None	6 months
6	57	Male	Pressure sore	2 ms	Sacro-coccygeal, perianal	2 V-Y sliding flaps	None	3 months
7	32	Male	Pressure sore	1 m	Sacro-coccygeal, perianal & extending to the ischium	2 V-Y sliding flaps	None	3 months
8	43	Male	Hidradenitis suppurativa	24 ms	Perianal	Split thickness skin graft (STSG)	Partial loss of skin graft	3 months
9	29	Male	Hidradenitis suppurativa	8 ms	Groin, pubic region, perineum and perianal	Direct closure	None	4 months
10	35	Male	Hidradenitis suppurativa	9 ms	Groin, perineum and perianal	Direct closure of part, Gracilis myocutaneous flap and STSG	Loss of skin paddle	6 months
11	27	Male	Hidradenitis suppurativa	5 ms	Groin and perianal	Direct closure	None	9 months
12	63	Male	Pressure sore	7 ms	Perineum	Hatchet flap (type I)	None	6 months
13	66	Male	Pressure sore	2 ms	Sacro-coccygeal and perianal	2 V-Y sliding flaps	None	6 months
14	66	Male	Necrotizing fasciitis	2 ms	Scrotum, Perineum and perianal	2 hatchet flaps (type II)	Disruption at the donor site of flaps	6 months
15	48	Male	Pressure sore	1 m	Sacro-coccygeal, perianal	2 V-Y sliding flaps	None	6 months
16	27	Female	Hidradenitis suppurativa	20 ms	Sacro-coccygeal, perianal	2 V-Y sliding flaps	None	5 years

RESULTS

All surgeries conducted on the 16 patients in the study period between February 2006 and February 2012 were without any intraoperative complications and all anaesthetized patients recovered uneventfully from the general anaesthesia with normal vital signs and high oxygen saturation on room air.

Advice was given to all patients to avoid pressure on flaps or shear of the graft and to be cautious while turning over in bed. The early postoperative period was uneventful in all patients and the average postoperative stay in hospitals was seven to fourteen days.

All patients obeyed the postoperative instructions and the suction drains were left in place for two weeks. Sutures were removed after one month in all cases.

Split-thickness skin graft applied at the perianal region in the patient numbered 8 in Table (1) showed 70% "take" and the first dressing was done on the 3rd postoperative days. At that time the tie over started to give offensive odor. On the other hand skin grafts applied at the donor sites of flaps in cases numbered 5&16 in Table (1) showed 100% "take" and the first dressing was done on the 5th postoperative day. The donor sites for the grafts healed uneventful in two weeks.

Healing in cases of direct closure numbered 9, 10 and 11 was excellent without any infection, disruption or delayed healing. Despite that the cause of the perianal defects was hidradenitis suppurativa no recurrence occurred in any of these three cases.

Elevated flaps whether sliding V-Y flaps, island flaps, hatchet flaps, or transposition flap showed no compromise in the vascularity and were inset in their place without any tension. The vascularity of the skin paddle of the gracilis myocutaneous flap was compromised and was debrided at the out-patient clinic. The exposed viable gracilis muscle was left to heal by 2^{ry} intention.

Disruption of the suture lines of the flaps was noticed in two cases and left to heal by 2^{ry} intention. Recurrence occurred twice in a case of hidradenitis suppurativa (case number 5 in Table 1) and repeated excision and reconstruction was performed in the same patient twice in a 4 year period.

Healing by 2^{ry} intention which was planned as in the patient numbered 5b in Table (1) or non-planned as after partial disruption of flap suture line or loss of part of perianal skin graft or after

loss of the skin paddle of gracilis myocutaneous flap was excellent and did not cause any functional impairment to the anal sphincter or limitation of movement.

Figs. (2-16) show preoperative and postoperative photos for perianal defects of various etiologies in 6 patients.



Fig. (1): A preoperative photo for extensive perianal hidradenitis suppurativa in a 43 year old male patient is shown.

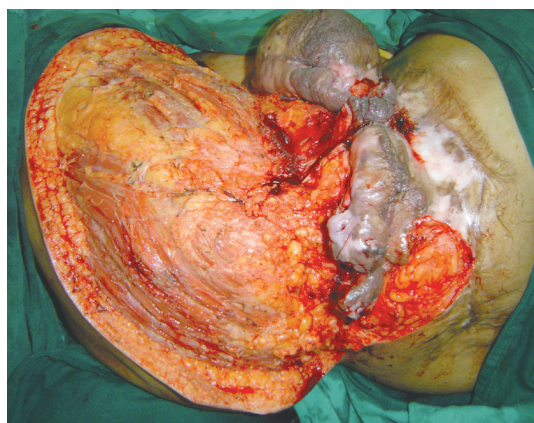


Fig. (2): An intraoperative photo for the perianal region of the same patient in Fig. (1) show extensive excision of the lesion down to the muscles.



Fig. (3): A preoperative photo shows the granulated raw area after debridement of perianal, perineal, scrotal and groin necrotizing fasciitis in a 48 year old male patient.



Fig. (4): An immediate postoperative photo for the same patient in Fig. (3) shows sliding V-Y flap based on inferior gluteal perforators covering the perianal region.



Fig. (5): An immediate postoperative photo for the same patient in Fig. (3) shows superiomedial hatchet type II thigh flap covering the perineal and scrotal region. The groin region was closed directly.



Fig. (6): A preoperative photo shows right side perianal lymphangioma circumscriptum in an 8 year old boy.



Fig. (7): An immediate postoperative photo for the same patient in Fig. (6) shows reconstruction by transposition flap from the posterior thigh and the donor site of the defect was closed by hatchet type II superiomedial thigh flap.



Fig. (8): A late postoperative photo for the same patient in Fig. (6) shows reconstruction by transposition flap from the posterior thigh and the donor site of the defect was closed by hatchet type II superiomedial thigh flap. The scars show hypertrophic changes.



Fig. (9): An intraoperative photo after excision of 3 areas affected by hidradenitis suppurative one perianal and the two others in the groins in a 27 year old male patient.



Fig. (10): An immediate postoperative photo for the same patient in Fig. (9) shows direct closure of the 3 defects.



Fig. (11): A preoperative photo for a 27 year old male paraplegic patient with pressure affecting the sacrococcygeal region and extends to the left perianal region and to the left ischium.



Fig. (12): An immediate postoperative photo of the same patient in Fig. (11) shows reconstruction using 2 sliding V-Y flaps based on superior and inferior gluteal arteries perforators. The 2 flaps surrounded the anus.



Fig. (13): A preoperative photo for 27 years old female patient with hidradenitis suppurative affecting the perianal region and extending to the sacro-coccygeal region.

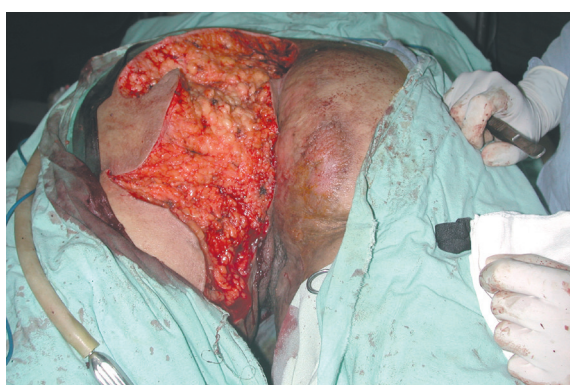


Fig. (14): An intraoperative photo for the same patient in Fig. (13) shows the defect left after excision of the lesion on the left side.



Fig. (15): An immediate postoperative photo for the same patient in Fig. (13) shows the reconstruction of the defect using two flaps: Sliding V-Y advancement flap based on the superior gluteal artery perforators and posterior thigh flap based on the profunda femoris artery perforators.



Fig. (16): A late postoperative photo for the same patient in Fig. (13) shows no recurrence to the hidradenitis suppurative for 5 years.

DISCUSSION

This article presents management of perianal defects of various etiologies. These include necrotizing fasciitis, hidradenitis suppurativa, lymphangioma circumscriptum and sacrococcygeal pressure sore.

Necrotizing fasciitis was first described by Pouteau in 1783 then by Jones in 1871 and Fournier in 1885 as phagedena, hospital gangrene and malignant ulcer respectively [3]. It involves both the

superficial and the deep fascia. It begins with fascial necrosis at onset and rapidly progresses to surrounding fascial planes. Eventually it affects the overlying skin and subcutaneous tissue [1]. This current study included two cases of perianal necrotizing fasciitis.

Hidradenitis suppurativa was first described by Velpeau in 1839 but it was not until the beginning of the 20th century that Schiefferdecker has reported the association of this disease with apocrine sweat glands [48].

Hidradenitis suppurativa is a recurrent, chronic inflammatory disease with complications such as abscesses, odiferous draining sinus tract formations, fistulisation, and scarring [7]. The most frequently affected sites are axilla, inguinal, perianal, perineal, inframammary, buttock and pubic region, chest, scalp, retroauricular area and eyelid [49]. It is recommended to resect all of the inflamed skin because if the affected area is large the patient may die from severe infection [6] and squamous cell carcinoma can grow from hidradenitis suppurativa [50-52]. Recurrence requiring secondary surgery

occurs in up to 70% of cases [53]. This current study included management of 7 cases of hidradenitis suppurativa. One of the cases showed twice attacks of recurrence within 4 years period.

Sacral pressure sore account for 17% of all pressure sores [54]. This figure was found by Dansereau and Conway in 1964 [54] who published what is to this day, the largest series of paraplegic patients with pressure sores. The single most important factor in the development of pressure sores is excessive and prolonged pressure on one position. In 1965 Lindan et al. [55] documented the distribution of pressure throughout the body and found greatest pressure over the sacrum in supine position. Tissue ischemia and necrosis of compressed tissues develop first at the deepest tissue next to the bone. Therefore pressure sores are typically sizable by the time skin breakdown is apparent. The larger the sacral pressure sores and the more protruding the coccyx the more the sacral pressure sores to reach the perianal region. This current study included 4 cases of sacrococcygeal pressure sore and one case of perineal pressure sore.

Lymphangioma circumscriptum is benign ectasia with two components: The clinically obvious dermal vesicular component visible on the skin and the deeper subcutaneous cisternal element [56]. Whimster described the pathogenesis and said that Lymphangioma circumscriptum arises from the subcutaneous muscle-coated lymphatic cisterns which receive lymphatic flow from the surrounding tissue but this is not drained to the normal lymphatic system [57]. These dilated cisterns conduct the lymph through communicating channels into the dermal thin lymphatics, which balloon out into the epidermis. Treatment modalities include surgery, laser and sclerotherapy with varying success [58-60]. This current study included one case of lymphangioma circumscriptum.

Healing by 2ry intention was considered by many authors [21,61-64] to be the standard procedure for perianal defects but Harison et al. [65] reported bad results with the use of 2ry intention healing method with delayed healing of up to 16 weeks. But in case of management of hidradenitis suppurativa healing by 2ry intention carries less recurrence rate and is uneventful [66,67]. In this study healing with 2ry intention whether planned or non-planned was excellent.

The plan to close the wound primarily should not be put before excision of the perianal lesion because it forces the surgeon to under excise the lesion leading to recurrence [53,68]. But if the area

left after complete excision of the lesion can be closed directly there will be no problem. Kagan and colleagues [48] and Buyukasik et al. [69] reported that 1ry closure after adequate excision of hidradenitis suppurativa does not increase the risk of recurrence. This current study showed the same results.

Whereas many authors advised the use of STSG to reconstruct perianal defects [6,26,64,70-73] others do not because the use of split-thickness skin grafts carries several drawbacks. This includes Morbidity to the donor and recipient sites, unsightly cosmetic and functional alteration [74]. The need for immobilization delays ambulation. It carries high rate of infection [75] due to bacterial contamination and high rate of graft failure up to 45% [65]. Contraction and anal stenosis after healing of split-thickness skin grafts are considered drawbacks of this technique [53]. The patient managed with perianal application of split-thickness skin graft in this study showed 30% loss of skin graft but no anal stenosis.

Contraction and limitation of movement frequently seen in 2ry intention healing, 1ry repair and closure with skin grafts are seen less frequently in flap repair method [70]. The cosmetic and functional results are better after skin flap reconstruction. Therefore, fasciocutaneous or musculocutaneous flaps are recommended [5,37,53,69,76]. Surely reconstruction using flap surgery in our study was more cosmetic but the areas healed by 2ry intention were cosmetically acceptable.

Some authors recommend temporary sigmoid colostomy to prevent fecal contamination of the wound [62,77] but others like Liron-Ruiz et al. [8] do not consider it necessary. They believe that adequate preoperative mechanical preparation of the colon, diet and postoperative constipating treatment is sufficient [8]. In this study we did not do colostomy for any of our patients.

Combination of local flaps and split-thickness skin grafts was used in this study in two cases and the same concept was previously mentioned by Liron-Ruiz et al. [8]. Flaps are used at perianal and pressure areas and the skin grafts at donor sites of the flaps. This helped closure of large donor sites of the flaps with no tension.

Multidisciplinary team including general surgeon experienced in anal surgeries, plastic surgeon and anesthesiologist is essential for adequate excision of perianal lesion with maintenance of the sphincteric function and perianal defect reconstruction.

Conclusion:

The principles adopted for reconstruction of perianal defects of various etiologies are the same regardless the etiology. Whereas using flaps for reconstruction is the best, reconstruction by leaving the defect to close by 2ry intention or direct closure of small defects and skin grafting of large defects are acceptable.

REFERENCES

- 1- Ulkur E., Karagoz H. and Celikoz B.: Tension-free treatment of large perianal necrotizing fasciitis using quartet rotationplasty. *Plast. Reconstr. Surg.*, 117: 993, 2006.
- 2- Mestrovic T., Cavcic J., Martinac P., et al.: Reconstruction of skin defects after radical excision of anorectal giant condyloma acuminatum: 6 cases. *JEADV*, 17: 541-545, 2003.
- 3- El-Khatib H.A.: V-Y fasciocutaneous pudendal thigh flap for repair of perineum and genital region after necrotizing fasciitis: Modification and new indication. *Ann. Plast. Surg.*, 48: 370, 2002.
- 4- Rees L., Moses M. and Clibbon J.: The anterolateral thigh (ALT) flap in reconstruction following radical excision of groin and vulval hidradenitis suppurativa. *J. Plast. Reconstr. Aesthet. Surg.*, 60 (12): 1363-5, 2007.
- 5- Kishi K., Nakajima H., Imanishi N. and Nakajima T.: Extended split superior gluteus maximus musculocutaneous flap and reconstruction after resection of perianal and lower gluteal hidradenitis suppurativa. *J. Plast. Reconstr. Aesthet. Surg.*, 62: 1081-6, 2009a.
- 6- Endo Y., Tamura A., Ishikawa O., et al.: Perianal hidradenitis suppurativa: early surgical treatment gives good results in chronic or recurrent cases. *Br. J. Dermatol.*, 139: 906-10, 1998.
- 7- Brown T.J., Rosen T. and Orenge I.F.: Hidradenitis suppurativa. *South. Med. J.*, 91: 1107-14, 1998.
- 8- Liron-Ruiz R., Torralba-Martinez J.A., Pellicer-Franco E., et al.: Treatment of long standing extensive perianal hidradenitis suppurativa using double rotation plasty, V-Y plasty and free grafts. *Int. J. Colorectal Dis.*, 19: 73-8, 2004.
- 9- Demirel A.H., Ongoren A.U., Bingul F. and Gulcelik N.: Total excision and V-Y plasty technique in the anal area condyloma acuminatum. *Ind. J. Plast. Surg.*, 41: 67-9, 2008.
- 10- Gordon P.H.: Condyloma acuminatum. In: Gordon P.H. and Nivatvongs S., (eds.). *Principles and practice of surgery for the colon, rectum and anus*. 2nd ed. Quality medical publishing: Missouri, p. 323-39, 1999.
- 11- Uribe N., Millan M., Flores J., et al.: Excision and V-Y plasty reconstruction for giant condyloma acuminatum. *Tech. Coloproctol.*, 8: 99-101, 2004.
- 12- Conklin A., Hassan I., Chua H.K., et al.: Long-term Functional and quality of life outcomes of patients after repair of large perianal skin defects for Paget's and Bowen's disease. *J. Gastrointest. Surg.*, 13: 951-955, 2009.
- 13- Marchesa P., Fazio V.W., Oliart S., et al.: Long-term outcome of patients with perianal Paget's disease. *Ann. Surg. Oncol.*, 4 (6): 475-80, 1997.
- 14- McCarter M.D., Quan S.H., Busam K., et al.: Long-term outcome of perianal Paget's disease. *Dis. Colon. Rectum.*, 46 (5): 612-6, 2003.
- 15- Cleary R.K., Schaldenbrand J.D., Fowler J.J., et al.: Treatment options for perianal Bowen's disease: Survey of American Society of colon and rectal surgeons members. *Am. Surg.*, 66: 686-8, 2000.
- 16- Ritz J.P., Runkel N., Haier J. and Buhr H.J.: Extent of surgery and recurrence rate of hidradenitis suppurativa. *Int. J. Colorectal Dis.*, 13 (4): 164-8, 1998.
- 17- Rompel R. and Petres J.: Long-term results of wide surgical excision in 106 patients with hidradenitis suppurativa. *Dermato. Surg.*, 26: 638-43, 2000.
- 18- Ariyan S. and Krizek J.: Hidradenitis suppurativa of the groin treated by excision and spontaneous healing. *Plast. Reconstr. Surg.*, 58: 44-47, 1976.
- 19- Seckel B.R., Schoetz D.J. and Collier J.A.: Skin grafts for circumferential coverage and perianal wounds. *Surg. Clin. North Am.*, 65: 365-71, 1985.
- 20- Notaras M.J., Murray W.J. and Manek S.: Use of skin graft knife in the treatment of giant perianal condyloma acuminatum. *Br. J. Surg.*, 77 (9): 1060-1, 1990.
- 21- Silverberg B., Smoot C.E., Landa S.J., et al.: Hidradenitis suppurativa: Patient satisfaction with wound healing by secondary intention. *Plast. Reconstr. Surg.*, 79: 555-9, 1987.
- 22- Beck D.E.: Paget's disease and Bowen's disease of the anus. *Semin. Colon. Rec. Surg.*, 6: 143-9, 1995.
- 23- Letterman G. and Schurter M.: Surgical treatment of hyperhidrosis and chronic hidradenitis suppurativa. *J. Invest. Dermatol.*, 63: 174-82, 1974.
- 24- Ramasastry S.S., Conklin W.T., Granick M.S. and Futrell J.W.: Surgical management of massive perianal hidradenitis suppurativa. *Ann. Plast. Surg.*, 15: 218-223, 1985.
- 25- Bishara B., Eitan A. and Barzilai A.: Malignant transformation of perianal condyloma acuminatum. *Harefuah*, 121: 230-31, 1991.
- 26- Bohn J. and Svensson H.: Surgical treatment of hidradenitis suppurativa. *Scand. J. Plast. Reconstr. Surg. Hand Surg.*, 35: 305-9, 2001.
- 27- Kuo H.W. and Ohara K.: Surgical treatment of chronic gluteal hidradenitis suppurativa: Reused skin graft technique. *Dermatol. Surg.*, 29: 173-8, 2003.
- 28- Yamada N., Matsuo A., Masuda R., et al.: Ideal skin grafting for pyoderma chronic. *Br. J. Plast. Surg.*, 55: 358-61, 2002.
- 29- Matsushita S., Ishihara T., Masuguchi S., et al.: The histopathological basis for employing the reused skin graft technique for chronic perianal pyoderma. *Plast. Reconstr. Surg.*, 114: 833-5, 2004.
- 30- St Peter S.D., Pera M., Smith A.A., et al.: Wide local excision and split-thickness skin graft for circumferential Paget's disease of the anus. *Am. J. Surg.*, 187: 413-416, 2004.
- 31- Lam D.T., Batista O., Weiss E.G., et al.: Staged excision and split-thickness skin graft for circumferential perianal Paget's disease. *Dis. Colon. Rectum.*, 44: 868-870, 2001.

- 32- Bell S.W., Dehni N., Chaouat M., et al.: Primary rectus abdominis myocutaneous flap for repair of perianal and vaginal defects after extended abdominoperineal resection. *Br. J. Surg.*, 92: 482-6, 2005.
- 33- Arkoulakis N.S., Angel C.L., DuBeshter B., et al.: Reconstruction of an extensive vulvectomy defect using the gluteus maximus fasciocutaneous V-Y advancement flap. *Ann. Plast. Surg.*, 49: 50-4, 2002.
- 34- Hurwitz D.J., Swartz W.M. and Mathes S.J.: The gluteal thigh flap: A reliable sensate flap for the closure of buttock and perineal wounds. *Plast. Reconstr. Surg.*, 68: 521-32, 1981.
- 35- Luo S., Raffoul W., Piaget F. and Egloff D.V.: Anterolateral thigh fasciocutaneous flap in the difficult perineogenital reconstruction. *Plast. Reconstr. Surg.*, 105: 171-3, 2000.
- 36- Wagstaff M.J., Rozen W.M., Whitaker I.S., et al.: Perineal and posterior vaginal wall reconstruction with superior and inferior gluteal artery perforator flaps. *Microsurgery*, 29: 626-29, 2009.
- 37- Kishi K., Nakajima H. and Imanishi N.: Reconstruction of skin defects after resection of severe gluteal hidradenitis suppurativa with fasciocutaneous flaps. *J. Plast. Reconstr. Aesth. Surg.*, 62: 800-5, 2009b.
- 38- Lin C.T., Chen S.G., Chen T.M., et al.: Successful management of osteoradionecrotic precoccygeal defect with free latissimus dorsi muscle flap: Case report and literature review. *Microsurgery*, 31: 490-4, 2011.
- 39- Vogt P.M., Kall S., Lahoda L.U., et al.: The free "mutton chop" flap: a fasciocutaneous flap for the reconstruction of the entire sacral and perineal area. *Plast. Reconstr. Surg.*, 114: 1220-4, 2004.
- 40- Petrie N., Branagan G., McGuinness C., et al.: Reconstruction of the perineum following anorectal cancer excision. *Int. J. Colorectal Dis.*, 24: 97-104, 2009.
- 41- Murakami K., Tanimura H., Ishimoto K., et al.: Reconstruction with bilateral gluteus maximus myocutaneous rotation flap after wide local excision for perianal extramammary Paget's disease. Report of two cases. *Dis. Colon. Rectum.*, 39: 227-231, 1996.
- 42- Terashi H., Shibata O., Yamamoto A., et al.: V-Y advancement posterior thigh fasciocutaneous flaps for total anal canal and large perianal defects. *Ann. Plast. Surg.*, 37: 340-341, 1996.
- 43- Hassan I., Horgan A.F. and Nivatvongs S.: V-Y island flaps for repair of large perianal defects. *Am. J. Surg.*, 181: 363-365, 2001.
- 44- Unal C., Yirmibesoglu O.A., Ozdemir J. and Hasdemir M.: Superior and inferior gluteal artery perforator flaps in reconstruction of gluteal and perianal/perineal hidradenitis suppurativa lesions. *Microsurgery*, 31: 539-44, 2011.
- 45- Hsu H., Lin C.M., Sun T.B., et al.: Unilateral gracilis myofasciocutaneous advancement flap for single stage reconstruction of scrotal and perineal defects. *J. Plast. Reconstr. Aesthet. Surg.*, 60 (9): 1055-9, 2007.
- 46- Ahmadzadeh R., Bergeron L., Tang M. and Morris S.: The superior and inferior gluteal artery perforators. *Plast. Reconstr. Surg.*, 120: 1551-6, 2006.
- 47- Elshahat A.: The versatility of the hatchet flap in soft tissue reconstruction and a proposed new classification. *Eur. J. Plast. Surg.*, 35: 351-357, 2012.
- 48- Kagan R.J., Yakuboff K.P., Warner P. and Warden G.D.: Surgical treatment of hidradenitis suppurativa: A ten year experience. *Surgery*, 138: 734-40, 2005.
- 49- Slade D.E., Powell B.W. and Mortimer P.S.: Hidradenitis suppurativa: Pathogenesis and management. *Br. J. Plast. Surg.*, 56 (5): 451-61, 2003, Review.
- 50- Altunay I.K., Gokdemir G., Kurt A., et al.: Hidradenitis suppurativa and squamous cell carcinoma. *Dermatol. Surg.*, 28: 88-90, 2002.
- 51- Lapins J., Ye W., Nyren O. and Emtestam L.: Incidence of cancer among patients with hidradenitis suppurativa. *Arch. Dermatol.*, 137 (6): 730-4, 2001.
- 52- Shukla V.K. and Hughes L.E.: A case of squamous cell carcinoma complicating hidradenitis suppurativa. *Eur. J. Surg. Oncol.*, 21 (1): 106-9, 1995, Review.
- 53- Mandal A. and Watson J.: Experience with different treatment modules in hidradenitis suppurativa: A study of 106 cases. *Surgeon*, 3 (1): 23-6, 2005.
- 54- Dansereau J.G. and Conway H.: Closure of decubiti in Paraplegics. Report of 2000 cases. *Plast. Reconstr. Surg.*, 33: 474-80, 1964.
- 55- Lindan O., Greenway R.M. and Piazza J.M.: Pressure distribution on the surface of the human body. I. Evaluation in lying and sitting positions using A "Bed of springs and nails". *Arch. Phys. Med. Rehabil.*, 46: 378-85, 1965.
- 56- Mortimer P.S.: Disorders of lymphatic vessels. In: Burns T., Breathnach S., Cox N. and Griffiths C. (Eds.) *Rook's textbook of dermatology*. 6th ed. Oxford: Blackwell Publishing, p. 2292, 1998.
- 57- Whimster I.W.: The pathology of lymphangioma circumscriptum. *Br. J. Dermatol.*, 94 (5): 473-86, 1976.
- 58- Browse N.L., Whimster I., Stewart G., et al.: Surgical management of lymphangioma circumscriptum. *Br. J. Surg.*, 73: 585-8, 1986.
- 59- Molitch H.L., Unger E.S., Witte C.L. and VanSonnenberg E.: Percutaneous sclerotherapy of lymphangiomas. *Radiology*, 194: 343-7, 1995.
- 60- Lapidot M., Ackerman L., Amital D.B., et al.: Treatment of lymphangioma circumscriptum with combined radiofrequency current and 900nm Diod laser. *Dermatol. Surg.*, 32: 790-94, 2006.
- 61- Wiltz O., Schoetz D., Murray J.J. and Veidenheimer M.C.: Perianal hidradenitis suppurativa. The lahey clinic experience. *Dis. Colon. Rectum.*, 33: 731-734, 1990.
- 62- Thornton J.P. and Abcarian H.: Surgical treatment of perineal hidradenitis suppurativa. *Dis. Colon. Rectum.*, 21: 573-577, 1978.
- 63- Weinzwieg N.: Hidradenitis suppurativa. In: Cohen M., ed. *Mastery of plastic and reconstructive surgery*. Little Brown, New York, pp 384-395, 1994.
- 64- Masson J.K.: Surgical treatment for hidradenitis suppurativa. *Surg. Clin. North Am.*, 49: 1043-52, 1969.
- 65- Harrison B.J., Mudge M. and Hughes L.E.: Recurrence after surgical treatment of hidradenitis suppurativa. *BMJ*, 294: 487-9, 1987.

- 66- Balik E., Eren T., Bulut T., Buyukuncu Y., et al.: Surgical approach to extensive hidradenitis suppurativa in the perineal/perianal and gluteal regions. *World J. Surg.*, 33: 481-7, 2009.
- 67- Ather S., Chan D.S.Y., Leaper D.J. and Harding K.G.: Surgical treatment of hidradenitis suppurativa: Case series and review of the literature. *Int. Wound J.*, 3: 159-69, 2006.
- 68- Watson J.D.: Hidradenitis suppurativa-a clinical review. *Br. J. Plast. Surg.*, 38: 567-9, 1985.
- 69- Buyukasik O., Hasdemir A.O., Kahramansoy N., et al.: Surgical approach to extensive hidradenitis suppurativa; *Dermatol. Surg.*, 37: 835-42, 2011.
- 70- Williams S.T., Busby R.C., DeMuth R.J. and Nelson H.: Perineal hidradenitis suppurativa: Presentation of two unusual complication and a review. *Ann. Plast. Surg.*, 26: 456-62, 1991.
- 71- Knaysi G.A., Cosman B. and Crikelair G.F.: Hidradenitis suppurativa. *JAMA.*, 203: 19-22, 1968.
- 72- Hartwell S.W.: Surgical treatment of hidradenitis suppurativa. *Surg. Clin. North Am.*, 55: 1107-9, 1975.
- 73- Paletta F.X.: Hidradenitis suppurativa: Pathologic study and use of skin flaps. *Plast. Reconstr. Surg.*, 31: 307-15, 1963.
- 74- Singer M. and Cintron J.R.: Hidradenitis suppurativa. *Clin. Colon. Rectal Surg.*, 14: 233-42, 2001.
- 75- Rubin R.J. and Chinn B.T.: Perianal hidradenitis suppurativa. *J. Am. Acad. Dermatol.*, 74: 1317-25, 1994.
- 76- Civelek B., Aksoy K., Bilgen E., et al.: Reconstructive options in severe cases of hidradenitis suppurativa. *Central Eur. J. Med.*, 5 (6): 674-8, 2010.
- 77- Billet A., Steuber K. and Vaughan L.: Hidradenitis suppurativa of unusual severity. *Ann. Plast. Surg.*, 10: 231, 1983.