GENERAL GYNECOLOGY

Abdominal wall endometriosis: 12 years of experience at a large academic institution

Amanda M. Ecker, MD; Nicole M. Donnellan, MD; Jonathan P. Shepherd, MD, MSc; Ted T. M. Lee, MD

OBJECTIVE: The objective of the study was to review patient characteristics and intraoperative findings for excised cases of abdominal wall endometriosis (AWE).

STUDY DESIGN: A 12 year medical record search was performed for cases of excised AWE, and the diagnosis was confirmed on pathological specimen. Descriptive data were collected and analyzed.

RESULTS: Of 65 patients included, the primary clinical presentation was abdominal pain and/or a mass/lump (73.8% and 63.1%, respectively). Most patients had a history of cesarean section (81.5%) but 6 patients (9.2%) had no prior surgery. Time from the initial surgery to presentation ranged from 1 to 32 years (median, 7.0 years), and time from the most recent relevant surgery ranged from 1 to 32 years (median, 4.0 years). Five patients (7.7%) required mesh for fascial closure following the resection of the AWE. We were unable to demonstrate a correlation between the increasing numbers of open abdominal surgeries and the time to presentation or depth of involvement. Age, body mass index, and parity also were not predictive of depth of involvement. There were increased rates of umbilical lesions (75% vs 5.6%, $P < .001$) in nulliparous compared with multiparous women as well as in women without a history of cesarean section (66.7% vs 1.9%, $P < .001$).

CONCLUSION: In women with a mass or pain at a prior incision, the differential diagnosis should include AWE. Although we were unable to demonstrate specific characteristics predictive for AWE, a large portion of our population had a prior cesarean section, suggesting a correlation.

Key words: abdominal wall endometrioma, cutaneous endometriosis, extrapelvic endometriosis, incisional endometriosis, scar endometriosis

Cite this article as: Ecker AM, Donnellan NM, Shepherd JP, et al. Abdominal wall endometriosis: 12 years of experience at a large academic institution. Am J Obstet Gynecol 2014;210:xx-xx.

Endometriosis is a common gynecological entity, defined as the ectopic growth of functioning endometrial glands and stroma. Gynecologists are most accustomed to its occurrence in the visceral peritoneum, but less frequently, it can involve lymph nodes, pericardium, pleura, or brain.[1,2] Endometriosis has also been documented in the scar tissue of abdominal incisions including laparoscopic port sites, hernia repairs, and laparotomies, and is collectively referred to as abdominal wall endometriosis (AWE).[3-7] The rates of AWE have been estimated to range from 0.04% up to 12%[8,9] in small cohorts of patients treated surgically for endometriosis. Unfortunately, because of disease rarity and the need for the pathological confirmation of diagnosis, it is difficult to study as a prospective cohort, which makes it impossible to comment on the true incidence.

Women with AWE can present with a variety of complaints including cyclic abdominal pain, a palpable mass, and/or pelvic pain symptoms consistent with endometriosis including dysmenorrhea, dyschezia, or dyspareunia.[10] Often women are referred to general surgery for excision, with the chief complaint of an abdominal wall mass or pain.

As a large academic institution, we have treated a substantial number of patients and were interested in identifying characteristics associated with AWE and defining the natural history of the disease in our patient population. Case series on AWE have previously been published, with study numbers ranging from 10 to 227.[11,12] However, our study will be the largest series published in the gynecological literature on a North American population to date. Here we report our institution's experience with abdominal wall endometriosis over a 12 year time period.

Materials and Methods

Following approval by the University of Pittsburgh Institutional Review Board, a retrospective review was performed of all hospital and office charts of patients treated for AWE at the University of Pittsburgh Medical Center between March 2001 and April 2013. Cases were identified by *International Classification of Diseases*, ninth revision, codes and confirmed via pathological specimen diagnosis (Figure 1). Cases were excluded if endometriosis was limited to the peritoneal layer alone.

Chart review extracted the following data: age at the time of excision, gravity/parity, race, body mass index (BMI), prior medical and surgical history, time to presentation/excision, specialty of primary surgeon, and incision type (open

From the Department of Obstetrics and Gynecology, Magee-Womens Hospital of UPMC, Pittsburgh, PA.

Received Jan. 31, 2014; revised March 21, 2014; accepted April 9, 2014.

The authors report no conflict of interest.

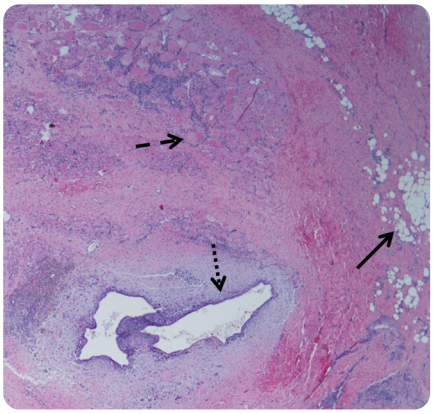
Presented in poster format at the 40th Annual Scientific Meeting of the Society of Gynecologic Surgeons, Scottsdale, AZ, March 23-26, 2014.

Reprints not available from the authors.

0002-9378/$36.00

http://dx.doi.org/10.1016/j.ajog.2014.04.011

FIGURE 1
Histology of an abdominal wall endometrioma



In this microscopic view of an excised abdominal wall endometrioma, endometrial glands (*dotted arrow*) are inappropriately adjacent to skeletal muscle (*dashed arrow*) and adipose cells (*solid arrow*).

Ecker. Abdominal wall endometriosis: a 12 year experience. Am J Obstet Gynecol 2014.

vs laparoscopic) as well as location and tissue layers involved.

Statistical analysis was performed using SPSS version 20 (IBM, Armonk, NY). Continuous data are reported as mean and SD when normally distributed, and as median and interquartile range (IQR) when not normally distributed. The comparisons of normally distributed, continuous data were made with a Student *t* test and an analysis of variance. The nonnormally distributed, continuous data were analyzed with Mann-Whitney *U* tests. The categorical data were analyzed with χ^2 and Fisher exact tests and are presented as counts and percentages.

RESULTS

A search based on the *International Classification of Diseases*, ninth revision, identified 98 potential subjects of which 90 records were available for review. An additional 25 subjects were excluded for either lack of pathologically confirmed endometriosis or endometriosis limited to the peritoneal cavity. Ultimately, 65 subjects who underwent the excision of pathologically confirmed AWE by a variety of subspecialty surgeons at our institution between March 2001 and April 2013 were analyzed. The mean patient age at the time of excision was 35 ± 8 years but ranged from 21 to 52 years. The majority were overweight or obese (70.8%), white (75.4%), and multiparous (87.3%). Additional patient characteristics are presented in Table 1. The majority presented with complaints of abdominal pain (73.8%) and/or a mass (63.1%). Other associated symptoms included dysmenorrhea, pelvic pain, dyspareunia, and bowel or bladder symptoms (Table 1). Two patients (3.1%) were asymptomatic and were incidentally diagnosed at the time of an unrelated surgery. A total of 30.8% of the patients were on pain medications at the time of presentation.

In our patient population, 81.5% reported a surgical history that included at least 1 cesarean section (Table 1). Interestingly, 6 patients (9.2%) had no prior surgical history, and the lesions in these cases were in the groin (n = 2) or umbilicus (n = 4). Five patients with a prior AWE excision (7.7%) underwent a second excision during the study period. The time from the initial relevant surgery of any kind to excision ranged from 1 to 32 years (median, 7.0 years; IQR, 4−11.5) and time from the most recent surgery ranged from 1 to 32 years (median, 4.0; IQR, 3−7). Both time intervals were recorded because it is impossible to determine which surgery was the potential inciting event. There was no difference in time from the initial surgery or most recent relevant surgery to excision (suggesting a delay in treatment) if the patient presented with abdominal pain alone ($P = .59$, $P = .19$).

The majority of patients with a prior cesarean section had pain at or near their prior incision (32.7% right lower quadrant, 32.7% left lower quadrant, and 16.3% nonspecific scar pain). Women with a prior cesarean section were significantly more likely than women without cesarean to have incisional lesions at the following locations: right (36.5% vs 8.3%), left (46.2% vs 0%), midline (11.5% vs 0%), ($P < .001$), but women without cesarean sections were more likely to have lesions at the umbilicus (Table 2). Nulliparous women also had higher rates of umbilical pain and lesions (Table 3).

For our purposes, skin was considered the deepest layer involved because of the presumed inoculation from the peritoneum directed outward. However, for completeness, the statistical analysis was also conducted with the peritoneal layer considered the deepest layer to ensure no false-negative findings. We were unable to show that an increasing number of cesarean sections influenced the depth of involvement ($P = .418$) or decreased the time to excision from either the initial or most recent relevant surgery ($P = .543$ and $P = .075$). Women without a prior cesarean section were more likely to have only skin involvement (16.7% vs 0%, $P = .027$), which correlates with their increased rates of umbilical involvement.

Our institution has no standardized protocol for preoperative diagnostic testing in these cases. Imaging varied by provider and 20% of patients (n = 13) had no preoperative imaging. Studies performed included abdominal and/or pelvic ultrasound, computed tomography, magnetic resonance imaging, and fine-needle aspiration (Table 1). Two providers utilized preoperative wire localization of the lesion in a total of 4 cases. Obesity was the only patient characteristic that predicted whether imaging was obtained but only for pelvic ultrasound (32% vs 10%, $P = .03$). Pelvic ultrasounds were ordered by all gynecological oncologists, 20.5% of gynecologists, and none of the general or plastic surgeons. We did not find a difference in imaging based on parity ($P = .978$).

The majority of AWE excisions were performed via open incision (75.4%; Table 4). The surgical approach utilized was not associated with the location of the lesion ($P = .198$) or the depth of invasion ($P = .978$). Gynecologists, including minimally invasive subspecialists, reproductive endocrinologists, and gynecological oncologists, performed 77% of the surgeries (Table 4). One hundred percent of the cases performed by plastic surgeons involved the skin layer, but only 18.2% performed by general surgeons and 0% by gynecologists involved the skin ($P = .018$). We did not appreciate any differences

when comparing the surgeon type to the presenting complaint, surgical approach, and/or time from first and most recent relevant surgery (data not shown).

The lesions involved the adipose layer in almost every case (96.9%) and fascia in more than half of the cases (67.2%; Table 4). Patient age, BMI, gravity/parity, and time from inciting event to surgical excision of AWE were not associated with depth of involvement (data not shown).

Comment

Our retrospective review identified 65 cases of pathology-confirmed AWE over 12 years. A large majority of our patients were white, overweight or obese, and multiparous, which likely represents the population demographics within which this study was performed.[13] Our hypothesis prior to initiation of this study was that increased numbers of cesarean sections with further distortion of tissue planes and anatomy would increase depth of involvement at time of excision and/or decrease time to presentation. However, we were unable to show any association between these factors. A post hoc calculation revealed that a sample size of 37 patients per group would have been necessary to show a difference in time to presentation based on a history of cesarean section (at 80% power). We were also unable to show associations of age, BMI, gravity/parity, and time from inciting event to surgical excision with depth of involvement.

More than 80% of our study population reported a history of cesarean section. Dissemination of endometriosis at the time of the cesarean section is biologically plausible because there is an opportunity for the inoculation of endometrial cells from the hysterotomy to the peritoneum or the abdominal wall.

We can also speculate about the origin of AWE in patients with no prior surgery from the various theories of peritoneal endometriosis origination. Our 2 cases of groin endometriosis may have been directly related to lymphatic spread, given that the external iliac lymph nodes receive drainage from the deep inguinal nodes, the pelvic viscera, and the abdominal wall below the level of the

TABLE 1
Baseline characteristics of patients with AWE[a]

Baseline characteristic	n (%)
BMI, kg/m^2	
<18.5 (underweight)	1 (1.5)
18.5-24.9 (normal weight)	18 (27.7)
25-29.9 (overweight)	21 (32.3)
≥30 (obese)	25 (38.5)
Race	
White	49 (75.4)
African American	13 (20)
Indian	1 (1.5)
Unknown	2 (3.1)
Gravity	
Nulliparous	8 (12.7)
Multiparous	55 (87.3)
Surgical history[b]	
Cesarean section	53 (81.5)
Laparoscopy	28 (43.1)
Laparotomy (excluding cesarean)	13 (20)
Prior AWE excision	5 (7.7)
No prior surgery	4 (6.2)
Presenting symptom(s)[c]	
Abdominal pain	48 (73.8)
Mass/lump	41 (63.1)
Pelvic pain	8 (12.3)
Dysmenorrhea	11 (16.9)
Dyspareunia	7 (10.8)
Bowel symptoms	4 (6.2)
Bladder symptoms	1 (1.5)
Asymptomatic (incidental finding)	2 (3.1)
Preoperative imaging	
Abdominal ultrasound	22 (33.8)
Pelvic ultrasound	12 (18.5)
CT	26 (40)
MRI	16 (24.6)
FNA	2 (3.1)
IR-guided wire localization	4 (6.2)
None	13 (20)

AWE, abdominal wall endometriosis; *CT*, computed tomography; *FNA*, fine-needle aspiration; *IR*, interventional radiology; *MRI*, magnetic resonance imaging.

[a] Data are categorical and given as frequency (percentage); [b] Percentages do not equal 100% because patients often presented with more than 1 type of prior surgery; [c] Percentages do not equal 100% because patients often presented with multiple symptoms.

Ecker. Abdominal wall endometriosis: a 12 year experience. Am J Obstet Gynecol 2014.

TABLE 2
Presentation and location differences based on history of cesarean section

Variable	Prior cesarean, n (%) (n = 53)	No cesarean, n (%) (n = 12)	*P* value
Dysmenorrhea	6 (11.3)	5 (41.7)	.024
Abdominal pain	42 (79.2)	6 (50)	.047
Umbilical pain	0 (0)	5 (50)	< .001
Lesion site: umbilicus	1 (1.9)	8 (66.7)	< .001

Ecker. Abdominal wall endometriosis: a 12 year experience. Am J Obstet Gynecol 2014.

umbilicus. Umbilical endometriosis may be explained by the fact that this is simply the thinnest portion of the abdominal wall or could be related to vascular or lymphatic spread and/or metaplastic transformation.

Diagnostic testing for AWE has previously been evaluated, and the typical ultrasound finding is a hypoechoic nodule with spiculated margins infiltrating the surrounding tissue.[14] Frequently, a hyperechoic ring surrounds the nodule (consistent with surrounding inflammation) with peripheral feeding vessels on color Doppler.[15] Unfortunately, an ultrasound can be limited both by patient habitus and ultrasonographer skill. Fine-needle aspiration is inconclusive in up to 75% of the cases with theoretical concerns about further tissue inoculation with needle passage.[8] The majority of lesions on magnetic resonance imaging appear hyperintense on T1- and T2-weighted images, consistent with blood products.[16] Computed tomography is a poor imaging modality because of the lack of resolution and radiation exposure.[17]

Management plans are not usually altered by imaging results, and a physical examination appears equivalent to imaging for a diagnosis of abdominal wall masses.[18] In our patient population, there was no consistent preoperative imaging technique performed, and 20% of the patients had no documented imaging. Obese women were more likely to have a pelvic ultrasound performed in their workup, and this may be explained by examination limitations associated with obesity.

With regard to recommendations for preoperative imaging, we believe that AWE is largely a clinical diagnosis. However, imaging studies may be necessary in cases in whom a hernia is strongly suspected or if concerns for extensive disease involving the fascia may require mesh reconstruction. Additionally, in clinical cases without an obvious mass but pain at the source of a prior incision, it is reasonable to perform imaging to rule out subfascial AWE. In these instances, preoperative wire localization of the lesion may be beneficial for intraoperative identification, particularly in the obese patient. However, in most classic clinical presentations with cyclic abdominal pain and an abdominal wall mass, surgical excision may be preferable for simultaneous diagnostic and therapeutic purposes (Figure 2).

TABLE 3
Presentation and location differences based on parity

Variable	Nulliparous, n (%) (n = 8)	Multiparous, n (%) (n = 55)	*P* value
Other pain source	5 (62.5)	5 (9.1)	.002
Umbilical pain	4 (66.7)	1 (2.1)	< .001
Lesion site: umbilicus	6 (75)	3 (5.6)	< .001

Ecker. Abdominal wall endometriosis: a 12 year experience. Am J Obstet Gynecol 2014.

Surgical management is most appropriate because previous studies evaluating the use of medical management in AWE have shown poor success.[19,20] Preliminary studies evaluating therapeutic percutaneous cryoablation have shown promise with a decrease in lesion volume.[21] However, there are rare reports of clear cell adenocarcinoma associated with AWE, further emphasizing the need for surgical excision.[22]

Historically, general surgery has performed these cases because of presenting complaints of abdominal pain or abdominal wall mass. At our institution, a high-volume women's hospital, nearly 80% of cases were performed by gynecologists, and we believe that this is appropriate in cases in which mesh implantation is not required for the closure of the fascial defect. A very small proportion of cases in our series (7.7%) required mesh closure, and one was due to AWE involving a previously placed mesh. A previously published trial reported rates of 77% for mesh placement and 7.7% for advanced skin flap repairs however; this is quite atypical and may be due to the fact that the average lesion size in this particular study was 4.8 cm.[23]

Weaknesses of this study are those inherent to a retrospective chart review. Retrospective reviews are subject to information bias in the form of missing or illegible data and/or errors in data collection. We cannot comment on the incidence of AWE with this study design. Follow-up data were extremely limited and limits the ability to make inferences about recurrence rates. A prior systematic review demonstrated recurrence rates ranging from 0% to 29%,[24] but future research needs to be directed toward further delineating the risk factors, incidence, and recurrence rates of AWE. To do this, a matched case-control trial would need to be completed with comprehensive, long-term follow-up.

Our study population had a cesarean rate of 81.5%, which is much greater than the usual population and suggests cesarean section as a leading risk factor, but we are unable to definitively make this association with a retrospective study. A case-control study design would allow the evaluation of cesarean section

TABLE 4
Surgical characteristics at time of AWE excision[a]

Characteristic	n (%)
Surgical approach	
Laparoscopic	5 (7.7)
Open	49 (75.4)
Combined	11 (16.9)
Primary surgeon	
General gynecologist	44 (72.1)
Gynecologic oncologist	3 (4.9)
General surgeon	11 (18)
Plastic surgeon	3 (4.9)
Layers excised[b]	
Skin	12 (18.8)
Subcutaneous/adipose	62 (96.9)
Fascia	43 (67.2)
Muscle	11 (17.2)
Peritoneum	13 (20.3)
Location of excised tissue	
Lateral incision, right	20 (31.3)
Lateral incision, left	24 (37.5)
Incision, midline	6 (9.4)
Incision, nonspecific	3 (4.7)
Groin	2 (3.1)
Umbilicus	9 (14.1)

AWE, abdominal wall endometriosis.

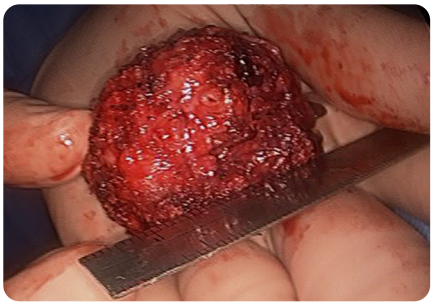
[a] Data are categorical and given as frequency (percentage); [b] Percentages do not equal 100% because patients often had involvement of multiple layers.

Ecker. Abdominal wall endometriosis: a 12 year experience. Am J Obstet Gynecol 2014.

as a risk factor and to what degree. Intraoperative data could be collected with details from prior cesarean sections including uterine exteriorization and abdominopelvic irrigation as well as peritoneal closure as potential contributors in the development of AWE; however, previous studies have shown that these surgical details are quite difficult to obtain.[25]

We believe it is important to draw attention to AWE for several reasons. Given the scarcity of publications within the gynecological literature, it is often overlooked by gynecologists in the differential diagnosis of abdominal pain, which can delay diagnosis and treatment. With recognition of specific risk factors and a better understanding of the disease course, we may be able to make recommendations for the prevention of AWE. ■

FIGURE 2
Gross pathology of an abdominal wall endometrioma



This 3 cm, well-circumscribed endometrioma was excised from the subcutaneous layer of a patient.

Ecker. Abdominal wall endometriosis: a 12 year experience. Am J Obstet Gynecol 2014.

ACKNOWLEDGMENT

We thank Dr Gabriela Quiroga-Garza for providing pathology photos.

REFERENCES

1. Sarma D, Iyengar P, Marotta TR, terBrugge KG, Gentili F, Halliday W. Cerebellar Endometriosis. AJR Am J Roentgenol 2004;182:1543-6.
2. Huang H, Li C, Zarogoulidis P, et al. Endometriosis of the lung: report of a case and literature review. Eur J Med Res 2013;18:13.
3. Efremidou EI, Kouklakis G, Mitrakis A, Liratzopoulos N. Polychronidis Ach. Primary umbilical endometrioma: a rare case of spontaneous abdominal wall endometriosis. Int J Gen Med 2012;5:999-1002.
4. Kang J, Baek J, Lee W, et al. Clinical manifestations of abdominal wall endometriosis: a single center experience. Arch Gynecol Obstet 2013;287:301-5.
5. Yuan L, Zhang JH, Liu XS. Clinicopathological features of 151 cases with abdominal wall endometriosis. Zhonghua Fu Chan Ke Za Zhi 2013;48:113-7.
6. Ozel L, Sagiroglu J, Baskent E, et al. Abdominal wall endometriosis in the cesarean section surgical scar: a potential diagnostic pitfall. J Obstet Gynaecol Res 2012;38:526-30.
7. Bergqvist A. Extragenital endometriosis: a review. Eur J Surg 1992;158:7-12.
8. Zhao X, Lang J, Leng J, Liu Z, Sun D, Zhu L. Abdominal wall endometriomas. Int J Gynaecol Obstet 2005;90:218-22.
9. Chang Y, Tsai EM, Long CY, Chen YH, Kay N. Abdominal wall endometriomas. J Reprod Med 2009;54:155-9.
10. Patterson G, Winburn G. Abdominal wall endometriomas: report of eight cases. Am Surg 1999;65:35-9.
11. Mostafa HA, Saad JH, Nadeem Z, Alharbi F. Rectus abdominis endometriosis. A descriptive analysis of 10 cases concerning this rare occurrence. Saudi Med J 2013;34:1035-42.
12. Ding Y, Zhu J. A retrospective review of abdominal wall endometriosis in Shanghai, China. Int J Gynaecol Obstet 2013;121:41-4.
13. Pittsburgh, Pennsylvania. US Census Bureau: state and county quick facts. Last revised: June 2013. Available at: http://quickfacts.census.gov/qfd/states/42/4261000.html. Accessed Dec. 10, 2013.
14. Francica G. Reliable clinical and sonographic findings in the diagnosis of abdominal wall endometriosis near cesarean section scar. World J Radiol 2012;4:135-40.
15. Francica G, Giardiello C, Angelone G, Cristiano S, Finelli R, Tramontano G. Abdominal wall endometriomas near cesarean delivery scars: sonographic and color Doppler findings in a series of 12 patients. J Ultrasound Med 2003;22:1041-7.
16. Genç B, Solak A, Şahin N, et al. Diffusion-weighted imaging in the evaluation of hormonal cyclic changes in abdominal wall endometriomas. Clin Radiol 2014;69:130-6.
17. Busard M, Mijatovic V, van Kuijk C, Hompes P, van Waesberghe JH. Appearance of abdominal wall endometriosis on MR imaging. Eur Radiol 2010;20:1267-76.
18. Minaglia S, Mishell D, Ballard C. Incisional endometriomas after cesarean section: a case series. J Reprod Med 2007;52:630-4.
19. Chatterjee S. Scar endometriosis: a clinicopathologic study of 17 cases. Obstet Gynecol 1980;56:81-4.
20. Rani RP, Soundararaghavan S, Rajaram P. Endometriosis in abdominal scars—review of 27 cases. Int J Gynaecol Obstet 1991;36:215-8.
21. Cornelis F, Petitpierre F, Lasserre AS, et al. Percutaneous cryoablation of symptomatic abdominal scar endometrioma: initial reports. Cardiovasc Intervent Radiol 2014 [Epub ahead of print].
22. Zhu Z, Al-Beiti MAM, Tang L, Liu X, Lu X. Clinical characteristic analysis of 32 patients with abdominal incision endometriosis. J Obstet Gynaecol 2008;28:742-5.
23. Zhu-feng L, Jin-hui W, Bing-qian C, et al. Resection and repair of large abdominal wall lesions in gynecologic patients. Chin Med J (Engl) 2013;126:1673-7.
24. Horton J, DeZee K, Ahnfeldt E, Wagner M. Abdominal wall endometriosis: a surgeon's perspective and review of 445 cases. Am J Surg 2008;196:207-12.
25. Lipscomb GH, Givens VM, Smith WE. Endometrioma occurring in abdominal wall incisions after cesarean section. J Reprod Med 2011;56:44-6.