

Case Report: Post Lumbar Discectomy Acute Iliac Arteriovenous Fistula; Endovascular Management and Literature Review

Mohamed A. Khoudir¹, Ghassan M. Aweja², Abdulkarim M. Katebi², Ahmed Farag³, Mahmoud S. Attia⁴, Mohmed S. Sobih⁵

¹Department of Neurosurgery, Portsaid University Hospital, Port Said, Egypt

²Department of Neurosurgery, Aseer Central Hospital, Abha, KSA

³Department of Neurosurgery, King Abdullah Medical City, Makkah, KSA

⁴Department of Vascular Surgery, National Institute of Diabetes and Endocrinology, Cairo, Egypt

⁵Department of Neurosurgery, Khamis Mushait General Hospital, Khamis Mushait, KSA

Email: dr_khodair2009@yahoo.com

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Abstract

Posterior approach lumbar disc surgeries (LDS) can be associated with serious iatrogenic vascular complications which could be a serious life threatening condition. We report a rare case of right sided acute iliac vessels iatrogenic arteriovenous fistula (IAVF) which was diagnosed and managed in 24 hours duration in a 45 years old healthy female who underwent surgical posterior approach L4-5 discectomy. Intraoperative, she developed sudden hypotension, tachycardia, wide pulse pressure and acute drop of hemoglobin level without obvious operative site bleeding which raise the index of suspicion of vascular injury and urge the team for doing emergency CT angiography (CTA), vascular and endovascular team consultation for digital subtraction angiography (DSA) and endovascular management. Endovascular stenting is nowadays the modality of choice of intervention. We provide case report with literature review.

Keywords

Iliac Arteriovenous Fistula, Post-Discectomy AVF, Endovascular

1. Introduction

Iatrogenic vascular injuries due to lumbar surgeries constitute about 0.02% - 0.06%. These injuries could be acute life threatening with rapid progressive deterioration of blood pressure due to retro-peritoneal hemorrhage or presented

with chronic complications of palpitation, abdominal distention, deep venous thrombosis (DVT) and bilateral lower limb swelling due to high cardiac output failure [1]. Chronic AVF can be easily diagnosed by history and physical examination findings. However, acute one usually has alarming symptoms and signs and rapidly needs imaging studies such as Doppler ultrasonography (US), computed tomography (CT), CT angiogram (CTA), digital subtraction angiogram (DSA) or MR angiography [1].

Our case report represents the first rare type of acute iatrogenic AVF which is usually presented with acute changes of blood pressure, pulse parameters and rapid lowering of hemoglobin level without evident surgical site bleeding. Early detection and rapid resuscitation with definitive endovascular management are lifesaving.

2. Case Report

A 45-year-old female who was presented to our hospital with acute onset of lower back pain referred to the left lower limb for almost 2 weeks duration which is not improving with and analgesia or Pregabalin medications. Upon examination, patient was conscious, oriented, motor power was intact in both lower limbs, with numbness of lumbar fifth nerve root distribution on the left side. Straight leg raising (SLR) test was positive on the left side at 30 degree, crossed SLR test was positive on the right side. Patient has normal sensation in saddle area, and normal anal tone. The patient has medical history of chronic hypertension which was controlled by Valsartan 80 mg twice daily. No other chronic medical conditions. MRI lumbar spine was done for the patient and huge left sided L4-5 disc prolapse compressing left L5 traversing nerve root, and caudally migrated as shown in **Figure 1**. Patient was prepared for surgery of L4-5 posterior lumbar discectomy. Routine surgery started and during disc removal sudden Hypotension, tachycardia was announced by anesthesia team which was controlled by intravenous infusion of isotonic fluid, no active bleeding in the surgical field was declared and post-discectomy blood loss was almost less than 50 ml.

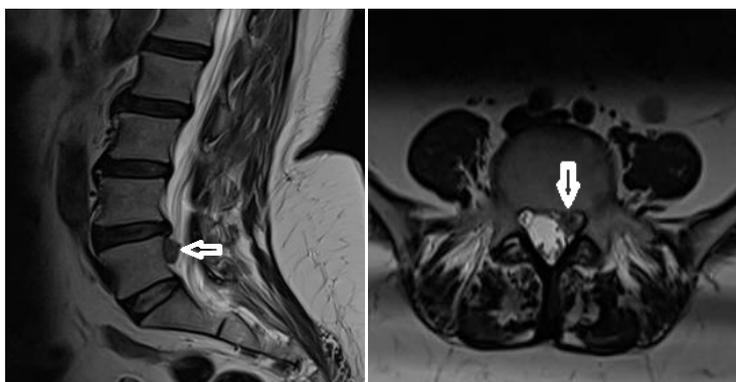


Figure 1. Showed preoperative left sided L4-5 disc prolapse, caudally migrated, compressing left sided neural exit foramina.

Postoperatively, the patient's hemoglobin dropped from 13 g/dL preoperatively to 10 g/dL. Patient was hypotensive 90/60 mmHg with pulse rate of 135/minute despite all corrective maneuvers of intravenous fluids, bed rest and close ICU monitoring. After few hours follow up in ICU, patient pulse was having tachycardia of 145 beat per minute, blood pressure was 150/50 (wide pulse pressure) with oxygen saturation of 99% on room air. Urgent CTA abdomen with contrast revealed right sided iliac vessels fistula and pseudo-aneurysm formation as shown in **Figure 2** and **Figure 3**. An abdominal bruit was noted, on auscultation, by vascular surgery team. Endovascular team shifted the patient to the angiography suite where a conventional angiogram was performed via the right iliac artery which showed right sided common iliac vessels pseudo-aneurysm and AVF as shown in **Figure 4**. A 10 × 40 mm endovascular stent graft was placed across the entry at the right common femoral artery following accurate localization of the AVF with different projection. Control angiograms showed closure of the fistula and no evidence of filling of the pseudo-aneurysm as shown in **Figure 5**. Stat normalization of blood pressure and pulse were regained after closure of the fistula while patient still on angiogram table. The patient was kept in the intensive care unit for 24 hours and then shifted to the ward. She was put on 75 mg Clopidogrel per day for 3 months (after a 300 mg loading dose the day of the procedure) and 100 mg acetylsalicylic acid per day indefinitely. The patient did well after closure of AVF, no pseudo-aneurysm filling, and pulse pressure return to normal level.

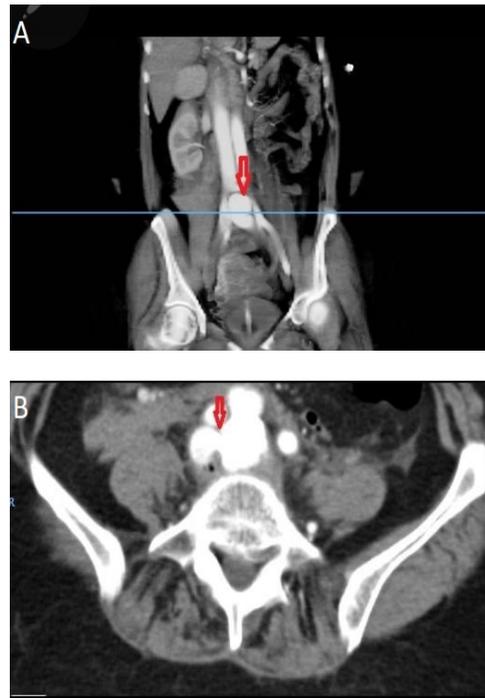


Figure 2. Immediate post-discectomy CTA, arterial phase, (A) showed coronal view with red arrow pointing at pseudo-aneurysm formation. (B) showed axial cuts with red arrow pointing at fistulous communications between iliac vessels and opacifications of veins due to shedding of arterial blood into venous system.



Figure 3. Immediate post-discectomy CTA, Venous phase. (A) showed coronal cuts and the pseudo-aneurysm, (B) showed axial cuts with red arrow pointing to fistula and blue arrow pointing to a point of pneumocephalus denoting penetration of anterior longitudinal ligament.

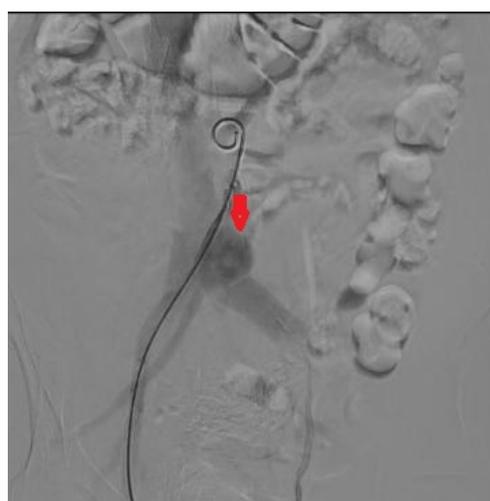


Figure 4. Digital Subtraction Angiography (DSA), (conventional angiogram) image reveals AVF and pseudo-aneurysm of right sided common iliac vessels and filling with dye (red arrow).

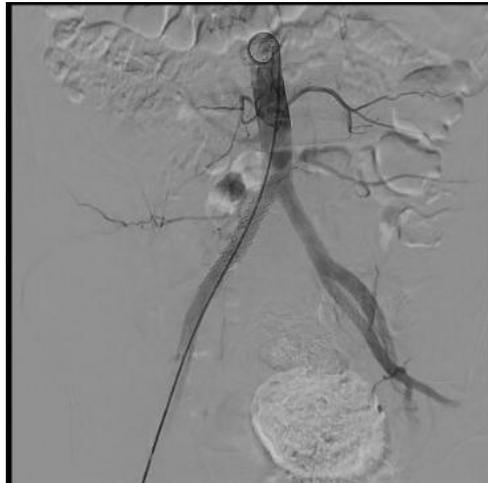


Figure 5. DSA intraoperative image after stenting showed complete closure of the fistula and no evidence of filling of the pseudo-aneurysm.

3. Discussion

Prevalence

Lumbar disc surgery is one of the most common procedures performed in neurosurgery practice. Iatrogenic arteriovenous fistula (AVF) is an unusual and potentially fatal complication of lumbar spinal surgery [1]. Vascular complications related to posterior lumbar disc surgery are very rare with incidence of major vascular injury of 0.01% - 0.05% as reported by Ana S *et al.* [2]. This nearly coincides with the results of Papadoulas *et al.*, during the period from 1990 to 2001 who claimed that the prevalence of an iatrogenic post lumbar discectomy vascular injury was 4 per 10,000 cases [3].

Etiology and predisposing factors

Poor operative technique during disc removal is not by default the only main cause of iatrogenic post-discectomy vascular injuries. There are other multiple factors usually associated with increased risk of these injuries which should be considered by all neurosurgeons before doing these surgeries.

- Inadequate, inappropriate, aggressive use and intrusion of disc forceps (the pituitary rongeur) [4].
- Long standing disc disease pathology leading to fibrosis of the annulus, anterior longitudinal ligament or peri-discal space [5].
- Abdominal compression in the prone position while performing the procedure, makes small space between the operated disc and the retroperitoneal vessels and expose the vessels for possible injuries [6].
- Previous lumbar or abdominal operations leading to adhesions between the lumbar vertebrae and the retroperitoneal vessels [7].
- Inadequate positioning of the patient [8].
- A hypertrophic spur and other bony vertebral anomalies which may render the retro-peritoneal vessels liable for compression and injury during the procedure [9].

Our case report doesn't have any potential risk factors from the list above. The injuries could be in the form of acute vascular laceration involving both arterial and venous vessels with arterial blood drainage into venous side leading to absent operative site bleeding and absent retro-peritoneal hemorrhage [10]. This may also explain why lowering of blood pressure may be absent in AVF as there is no blood leaves the vascular channels. Thus, high pulse rate and lowering of hemoglobin remain the main clue to discover AVF. Otherwise, it may remain unrecognized for long time [11]. Our case report revealed immediate acute formation of an AVF and pseudo-aneurysm which was reported in Franzini M *et al.* 1987 [12] and Papadoulas S *et al.* 2002 [3] studies. Late presentation of Pseudo-aneurysms is usually caused by a localized arterial wall injury. On the other side, delayed hemorrhage and/ or thrombosis can be a result of arterial contusion of a major blood vessel [13].

Anatomical factors affecting iatrogenic vascular injuries

In the occurrence of IAVF following an LDS, a critical position of anatomy has been declared. The path of the aortic artery lies predominantly along the left side of the anterior vertebral body, while the inferior vena cava typically travels along the right side. At the center of the 4th lumbar vertebra, or also at its lower lip, the left and right CIA are aorta divisions. At the same level, the union of common iliac veins to form the IVC occurred. Only the anterior longitudinal ligament separates these vascular channels at this lumbar spine point from the disc space, which may explain the ease of occurrence of IAVFs due to deep bite with the pituitary rongeur [14].

Injuries of the aortic artery and inferior vena cava are most common at the level of lumbar 3 and 4 disc spaces, while iatrogenic injuries of the iliac arteries and veins usually happen much lower levels of L4 - L5 and L5 - S1 disc spaces. Another less common injuries at the same level can happened like internal iliac vessels [15], superior and inferior mesenteric vessels [8], and other more rare vessels entities [12]. Goodkin R *et al.* reported in his literature that the most commonly injured artery is the left common iliac artery, which lies anterior to the L4-L5 vertebral disc [16].

Clinical picture and time interval for IAVF

AVF sometimes not presents with serious symptoms in the first 24 hours, in comparison to vascular lacerations. Yan GW *et al.* 2019, in his systematic review of 18 years' experience of Iatrogenic arteriovenous fistula of the iliac artery after lumbar discectomy surgery in 44 patients revealed that The time period between LDS and IAVF identification in his patients was less than 24 hours in 4 patients (9.1 percent). Other time factors were as follows: 24 hours to 1 week in 3 patients (6.8 percent), 1 week to 1 month in 9 patients (20.5 percent), 1 month to 1 year in 15 patients (34.1 percent), and more than 1 year in 13 patients (29.5 percent), while the longest time span between all patients is 17 years (2.3%) [17]. Our case report was detected and treated within 24 hours postoperatively.

IAVF may be early presented with hypotension, tachycardia, wide pulse pres-

sure, rapid lowering of hemoglobin level and abdominal distension secondary to hypovolemia. These symptoms may be due to retro-peritoneal blood collection or rapid loss of arterial blood into venous channels. Unexplained anemia may be the only clue to the injury. Most of the time, the presentation is late after weeks or years after the surgery because of the asymptomatic development of a pseudo-aneurysm or an AVF. The most common late presentation of asymptomatic vascular injuries is manifestation of high-output cardiac failure including leg edema, dyspnea, and back pain develop in the late phase as a result of high-flow AVF [3]. Zhou W *et al.* concluded that, operative site external bleeding occurs in only quarter of vascular injuries cases during laminectomy [18].

Diagnosis and differential diagnosis of IAVF

For detection and diagnosis of IAVF, CTA either alone or together with DSA are the main tools for diagnosis of IAVF. Accurate delineation of the site, size, anatomy of artery and vein, presence of pseudo-aneurysm can be determined accurately using CTA study [19]. Based upon CTA scans, surgeons can put a plan for surgical intervention of AVF and expect the associated potential risks. DSA is still considered the modality of choice for AVFs diagnosis but it is an invasive procedure. MRA is non-invasive type so can be used in patients with chronic renal disease, young or pregnant subjects, and those who require multiple examinations [20]. The late presentation of IAVF has several differential diagnoses, including deep vein thrombosis, pulmonary embolism, non-high output cardiac failure, primary pulmonary hypertension, and some other specific diseases that may occur in the heart, lung, and vascular regions [21]. A careful detailed medical history, accurate comprehensive physical examination, and perfect selection of the imaging modalities needed, are the key factors in the process of accurate diagnosis of IAVF.

Types of interventions for IAVF

Putting a coated stent graft on an arterial or venous site, embolizing the affected vessel or using both approaches for IAVF intervention are the modalities of treatment for IAVF [22]. Akpınar B *et al.* 2009 [22] presented a case of post lumbar discectomy life-threatening bleeding which was early diagnosed by CTA to have common iliac artery pseudo-aneurysm and iliac arteriovenous fistula and successfully managed by endovascular approach and stent graft placement. Laparotomy intervention is another method of surgical repair of IAVF. In the series of Yan GW *et al.* 2019 [17], traditional open surgeries were done in 4 patients (9.3%), and endovascular interventions were done in thirty-nine patients (90.7%).

Hypotension, tachycardia, broad pulse pressure, rapid lowering of hemoglobin level and abdominal distension secondary to hypovolemic state were our clues for diagnosis of our case detection at an early stage which were uncontrolled and cannot be corrected even with aggressive intravenous fluids and blood administration. Interventional catheter angiography and stent placement immediately return pulse to normal and correct the wide pulse pressure.

4. Conclusion

We present a case report of post lumbar discectomy Acute IAVF which is potentially a serious life-threatening complication and should be early detected by clinical findings of sudden decrease of blood pressure, tachycardia, wide pulse pressure and acute hemoglobin level drop. For proper diagnosis confirmation requires emergency CTA, vascular surgery team consultation and endovascular team opinion for further investigations of digital subtraction angiography, and management of these injuries. Endovascular stenting is nowadays the method of choice for low morbidity and mortality intervention with early and painless recovery. Restoring normal blood pressure and pulse parameter is achieved immediately after insertion of the stent and closure of the fistula while the patient is still on the conventional angiography room operating table. Our case diagnosis and management were done in less than 24 hours duration which is reported in Avery's few case reports.

Consent

Written informed consent was obtained from the patient. A copy of the consent form is available for review by the Editor of this journal

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

- [1] Ocal, O., Peynircioglu, B., Eldem, G., Akpinar, E., Onur, M.R. and Kabakci, G. (2017) Iliac Arteriovenous Fistulas after Lumbar Spinal Surgery. *Turkish Journal of Emergency Medicine*, **17**, 109-111. <https://doi.org/10.1016/j.tjem.2017.03.001>
- [2] Anda, S., Aakhus, S., Skaanes, K.O., Sande, E. and Schrader, H. (1991) Anterior Perforations in Lumbar Discectomies. A Report of Four Cases of Vascular Complications and a CT Study of the Prevertebral Lumbar Anatomy. *Spine*, **16**, 54-60. <https://doi.org/10.1097/00007632-199101000-00011>
- [3] Papadoulas, S., Konstantinou, D., Kourea, H.P., Kritikos, N., Haftouras, N. and Tsolakis, J.A. (2002) Vascular Injury Complicating Lumbar Disc Surgery. A Systematic Review. *European Journal of Vascular and Endovascular Surgery*, **24**, 189-195. <https://doi.org/10.1053/ejvs.2002.1682>
- [4] Villano, M., Cantatore, G., Narciso, N., Santilli, F., Bifano, D. and Cerillo, A. (1992) Vascular Injury Related to Lumbar Disk Surgery. *Minimally Invasive Neurosurgery*, **35**, 57-59. <https://doi.org/10.1055/s-2008-1052247>
- [5] Bolesta, M.J. (1995) Vascular Injury during Lumbar Discectomy Associated with Peridiskal Fibrosis: Case Report and Literature Review. *Journal of Spinal Disorders*, **8**, 224-227. <https://doi.org/10.1097/00002517-199506000-00008>
- [6] Raptis, S., Quigley, F. and Barker, S. (1994) Vascular Complications of Elective Lower Lumbar Disc Surgery. *Australian and New Zealand Journal of Surgery*, **64**, 216-219.
- [7] Serrano Hernando, F.J., Paredero, V.M., Solis, J.V., Del Rio, A., Lopez Parra, J.J.,

- Orgaz, A., Aroca, M., Tovar, A. and Paredero del Bosque, V. (1986) Iliac Arteriovenous Fistula as a Complication of Lumbar Disc Surgery. Report of Two Cases and Review of Literature. *The Journal of Cardiovascular Surgery*, **27**, 180-184.
- [8] Torun, F., Tuna, H. and Deda, H. (2007) Abdominal Vascular Injury during Lumbar Disc Surgery: Report of Three Cases. *Turkish Journal of Trauma & Emergency Surgery*, **13**, 165-167. <https://pubmed.ncbi.nlm.nih.gov/17682963/>
- [9] Jarstfer, B.S. and Rich, N.M. (1976) The Challenge of Arteriovenous Fistula Formation Following Disk Surgery: A Collective Review. *The Journal of Trauma: Injury, Infection, and Critical Care*, **16**, 726-733. <https://doi.org/10.1097/00005373-197609000-00008>
- [10] Erkut, B., Ünlü, Y., Kaygın, M.A., Çolak, A. and Erdem, A.F. (2007) Iatrogenic Vascular Injury during to Lumbar Disc Surgery. *Acta Neurochirurgica*, **149**, 511-516. <https://doi.org/10.1007/s00701-007-1132-2>
- [11] Smith, D.W. and Lawrence, B.D. (1991) Vascular Complications of Lumbar Decompression Laminectomy and Foraminotomy. A Unique Case and Review of the Literature. *Spine*, **16**, 387-390. <https://doi.org/10.1097/00007632-199103000-00030>
- [12] Franzini, M., Altana, P., Annessi, V. and Lodini, V. (1987) Iatrogenic Vascular Injuries Following Lumbar Disc Surgery. Case Report and Review of the Literature. *The Journal of Cardiovascular Surgery*, **28**, 727-730. <https://europepmc.org/article/med/3667685>
- [13] Szolar, D.H., Preidler, K.W., Steiner, H., Riepl, T., Flaschka, G., Stiskal, M. and Norman, D. (1996) Vascular Complications in Lumbar Disk Surgery: Report of Four Cases. *Neuroradiology*, **38**, 521-525. <https://doi.org/10.1007/BF00626086>
- [14] Kiguchi, M., O'Rourke, H.J., Dasyam, A., Makaroun, M.S. and Chaer, R.A. (2010) Endovascular Repair of 2 Iliac Pseudoaneurysms and Arteriovenous Fistula Following Spine Surgery. *Vascular and Endovascular Surgery*, **44**, 126-130. <https://doi.org/10.1177/1538574409352809>
- [15] Rohit, M.K., Gupta, A. and Khandelwal, N. (2016) Endovascular Transluminal Stent Grafting: Treatment of Choice for Post Lumbar Spine Surgery Iliac Arterio-Venous Fistulae. *Catheterization and Cardiovascular Interventions*, **88**, E203-E208.
- [16] Goodkin, R. and Laska, L.L. (1998) Vascular and Visceral Injuries Associated with Lumbar Disc Surgery: Medicolegal Implications. *Surgical Neurology*, **49**, 358-372. [https://doi.org/10.1016/S0090-3019\(97\)00372-8](https://doi.org/10.1016/S0090-3019(97)00372-8)
- [17] Yan, G.W., Li, H.W., Yang, G.Q., Bhetuwal, A., Liu, J.P., Li, Y., Wu, L., et al. (2019) Iatrogenic Arteriovenous Fistula of the Iliac Artery after Lumbar Discectomy Surgery: A Systematic Review of the Last 18 Years. *Quantitative Imaging in Medicine and Surgery*, **9**, 1163. <https://doi.org/10.21037/qims.2019.05.12>
- [18] Zhou, W., Bush, R.L., Terramani, T.T., Lin, P.H. and Lumsden, A.B. (2004) Treatment Options of Iatrogenic Pelvic Vein Injuries: Conventional Operative versus Endovascular Approach. *Vascular and Endovascular Surgery*, **38**, 569-573. <https://doi.org/10.1177/153857440403800612>
- [19] Edwards, E.A., Lee, M.M., Acord, M.R. and Courtier, J. (2020) Abdominal Applications of Pediatric Body MR Angiography: Tailored Optimization for Successful Outcome. *American Journal of Roentgenology*, **215**, 206-214. <https://doi.org/10.2214/AJR.19.22289>
- [20] Liu, B.C., Ye, K.F., Gao, S., Liu, K.X., Feng, H., Zhou, F. and Tian, Y. (2019) The Summary of Experience of Abdominal Vascular Injury Related to Posterior Lumbar Surgery. *International Orthopaedics*, **43**, 2191-2198. <https://doi.org/10.1007/s00264-018-4262-7>

- [21] Cronin, P., McPherson, S., Meaney, J.F. and Mavor, A. (2002) Venous Covered Stent: Successful Occlusion of a Symptomatic Internal Iliac Arteriovenous Fistula. *Cardiovascular and Interventional Radiology*, **25**, 323-325.
<https://doi.org/10.1007/s00270-001-0116-5>
- [22] Akpınar, B., Peynircioglu, B., Çil, B., Daglıoğlu, E. and Çekirge, S. (2009) Iliac Vascular Complication after Spinal Surgery: Immediate Endovascular Repair Following CT Angiographic Diagnosis. *Diagnostic and Interventional Radiology*, **15**, 303-305.
<https://doi.org/10.4261/1305-3825.dir.1018-07.4>