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Improved Patency of Transjugular Intrahepatic Portosystemic Shunts in Humans

ABSTRACT & COMMENTARY

Synopsis: *Haskal reports the results of transjugular intrahepatic portosystemic shunts (TIPS) in humans using PTFE-covered Wallstents placed in 13 patients. Seven covered stents were placed at shunt creation and seven during revision of TIPS. Persistent biliary-TIPS fistulas were demonstrated in six cases, prior to stent-graft placement despite repeated shunt revisions with additional metallic stents. Results showed that all but one stent-graft TIPS were patent by portal venography at a mean follow-up duration of 19 months. Only one patient developed TIPS thrombosis due to a persistent biliary-TIPS fistula.*

Source: Haskal ZJ. Improved patency of transjugular intrahepatic portosystemic shunts in humans: Creation and revision with PTFE stent-grafts. *Radiology* 1999;213(3):759-766.

One of the well-documented problems with tips is their limited and unpredictable patency. Stenoses greater than 50% and recurrent portal hypertension develop in 25-50% of cases within 6-12 months of shunt creation. Shunt surveillance and revisions are necessary to maintain long-term patency. The purpose of this study was to expand on stent-graft TIPS data by reporting results with PTFE stent-grafts used for both creation and revision of TIPS. Thirteen patients (8 men, 5 women; mean age, 54 years) with portal hypertension were included in the study. Seven shunts were created de novo with PTFE grafts, and seven pre-existing shunts were revised by using the stent-grafts. One patient had two revisions with stent-grafts due to early failure of one revision. The indications for TIPS were variceal bleeding in 10 patients, refractory ascites and a refractory large right hepatic hydrothorax in one, refractory ascites in one, and Budd-Chiari syndrome in one. Seven patients had undergone shunt revision because of TIPS thrombosis, and biliary-TIPS fistulae were documented in six cases by means of gentle injection of iodinated contrast material into the occluded shunts. The fistulae persisted despite shunt thrombectomies and reopening of the

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lumina with additional Wallstents. The stent-grafts were put together on a sterile tabletop at the time of TIPS revision or initial shunt creation. The length of the segment to be lined with PTFE was from the portal venous entry site to the caval ostium. A 3- or 4-mm-diameter standard thin-wall PTFE graft was dilated using 10- or 12-mm dry high-pressure balloons. The pre-expanded graft material was cut to length and sutured solely at the leading end of the Wallstents. The device was introduced into the patient through a 30-cm-long 16-F sheath. Results showed that stent-grafts were placed accurately without incidents and no associated complications. The mean duration of venographic follow-up was 19 months and none of the patients developed recurrence of the symptoms that led to the initial TIPS placement. All but one graft-lined TIPS in both new and revision groups were widely patent at follow-up. Asymptomatic stent-graft thrombosis occurred at three weeks of graft implantation in one patient. A parallel transcaval shunt was formed between the retrohepatic cava and the left portal vein and was immediately formed with a new stent-graft.

COMMENT BY MONI STEIN, MD

Randomized clinical trials comparing TIPS and endoscopic sclerotherapy have shown that average rate of variceal rebleeding after TIPS was approximately 30%—less than sclerotherapy. In almost all cases, rebleeding after TIPS formation is related to shunt malfunction. Solving the problem of TIPS durability could broaden its clinical application and benefit and restore its credibility as a long-lasting solution. Animal work has shown that histologic and venographic study of animals with TIPS lined with stent-grafts revealed near-absence of any tissue within the shunt. The overall patency of the graft group was good, in marked contrast to that in control animals (with conventional stents), which developed occlusions or marked stenoses (40-72%) within four weeks of TIPS.[1] TIPS shunts with severe stenoses or occlusions develop severe neointimal hyperplasia, which appears as a thick rind of myofibroblasts and extracellular collagen matrix. This process is worse in the intrahepatic shunt and venous outflow and is thought to limit long-term patency. In acute TIPS occlusions, TIPS-biliary fistulas are a common factor. In both acute and long-term occlusions, PTFE-lined stent-grafts are considered the most promising development that will likely prolong TIPS durability. A new multicenter FDA trial has been launched with a new generation device that will likely revolutionize this procedure. Andrews et al evaluated the potential benefits of placing a PTFE-covered stent-graft during initial creation of a TIPS in clinical practice.[2] De novo TIPS were created with a PTFE stent-graft in four men and four women with symptomatic portal hypertension awaiting liver transplant. Patients were followed with TIPS ultrasound (US) and/or venography until liver transplantation or death. Six recovered specimens underwent gross and microscopic evaluation. All TIPS placements were successful and six shunts were primarily patent, with a mean patency of 289 days. Five were found to be patent at transplant and one was found to be patent at autopsy. Three patients developed a total of four stenoses (one tandem lesion) during follow-up, leading to revision in two patients. Only one (nonsignificant) stenosis clearly developed in an area covered by PTFE. Haskal concludes that placement of a de novo PTFE stent-graft during TIPS formation is feasible and may extend primary shunt patency. It is my prediction that in 2-3 years most TIPS will be performed with stent-grafts, resulting in improved patency rates and clinical credibility. ❖

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Making a Diagnosis of Osteochondritis Dissecans with Sonography

ABSTRACT & COMMENTARY

Synopsis: *Sonography can be used to make a diagnosis of osteochondritis dissecans of the humeral capitellum and can classify a lesion as nondisplaced and either stable or unstable. MR is recommended to assess the stability of lesions precisely.*

Source: Takahara M, et al. Sonographic assessment of osteochondritis dissecans of the humeral capitellum. *AJR Am J Roentgenol* 2000;174:411-415.

Conventional radiography understages osteochondritis dissecans; therefore, radiography with the elbow in 45° of flexion is suggested to allow clearer visualization of osteochondritis dissecans of the capitellum. This study was performed to address whether sonography enables the observer to distinguish between stable and unstable lesions.

Twenty-seven subjects with osteochondritis dissecans of the capitellum were assessed with anteroposterior extended, anteroposterior in 45° of flexion, and lateral views. Sonography of the capitellum was obtained in two directions: anterior and posterior longitudinal views.

Radiography showed that 10 lesions were stable and 17 were unstable. Sonography showed eight stable and 19 unstable leasions. Magnetic resonance (MR) showed three stable and seven unstable lesions. Sonography and radiography agreed in 23 cases and disagreed in four. Surgical findings confirmed 13 of the 15 radiographic assessments and revealed that two radiographic assessments had been underestimations. In these two lesions, sonography revealed the lesions were unstable and the finding was confirmed with MR and surgery. Thus, although assessment with AP radiographs with the elbow in 45° of flexion is useful, additional use of sonography and MR imaging is helpful to avoid underestimating the severity of osteochondritis dissecans of the capitellum.

COMMENT BY BEVERLY P. WOOD, MD

Sonography is useful in evaluating osteochondritis dissecans of the elbow as a dynamic study and one that is sensitive in visualizing subchondral bone and articular cartilage simultaneously. Sonography should identify unstable lesions, but apparently did not always indicate instability or complications such as synovitis or contracture. MR imaging was needed to obtain more information about lesions. ❖

Is a Full Bladder Still Necessary for Pelvic Sonography?

ABSTRACT & COMMENTARY

Synopsis: *This study confirms that transvaginal sonography, with an empty bladder, is all that is required for most pelvic ultrasound examinations. Adjunctive transabdominal scans will occasionally be required when there is a pelvic mass, but even in these cases bladder distention should be avoided.*

Source: Benacerraf BR, et al. Is a full bladder still necessary for pelvic sonography? *J Ultrasound Med* 2000;19:237-241.

During the past decade, transvaginal ultrasound has gradually become the preferred method for imaging female pelvic organs. To optimize this approach, the patient's urinary bladder should be empty. If the study is technically unsatisfactory or incomplete, the patient is usually instructed to drink approximately one liter of fluid, wait until her bladder is distended, and undergo a repeat ultrasound examination using a transabdominal (transvesical) approach. To determine whether a distended bladder is an absolute necessity for the transabdominal portion of the examination, Benacerraf and associates did a one-month prospective study of 206 consecutive patients referred for a pelvic ultrasound examination.

The initial part of the study consisted of an experienced sonographer performing a transabdominal scan through a distended bladder. Immediately thereafter, the patient voided, and an experienced sonologist (who was blinded to the transabdominal findings) did a transvaginal pelvic ultrasound examination. Subsequently, the sonologist repeated the transabdominal scan, but the bladder remained empty. At the completion of these three examinations, the sonographer and sonologist conferred, and decided if all pertinent pelvic anatomy was visible: 1) by transvaginal imaging alone; 2) by transvaginal plus transabdominal scans (the latter done through an empty bladder); or 3) by transabdominal scans (through a full bladder).

The results of this study showed that transvaginal scans alone were satisfactory to image the uterus and both ovaries in 172 patients (83.5%), and that transabdominal scans were necessary for the remaining 34

patients (16.5%). Noteworthy, however, was that of the 34 patients who required additional transabdominal scans, satisfactory images were obtained with an empty urinary bladder in 31 of these cases, and that only three cases required a distended bladder. Further analysis revealed that 25% of women with an enlarged uterus (primarily due to fibroids) required transabdominal scans (with an empty bladder), while more than 95% of patients with a normal size uterus were satisfactorily studied using only the transvaginal route.

COMMENT BY FAYE C. LAING, MD

Because transvaginal scans are usually done with a 5-MHz transducer while transabdominal scans often require a 3.5-MHz transducer, it should not surprise us that several comparative ultrasound studies agree uniformly that transvaginal scans yield more diagnostic information than transabdominal scans.[1-3] Consequently, many sonologists now routinely begin pelvic ultrasound examinations using a transvaginal approach and an empty urinary bladder. Subsequent transabdominal scans are reserved for a subset of women in whom transvaginal imaging either incompletely or inadequately visualized the pelvic organs. Not only does this approach save time, but it also minimizes patient discomfort, since most women will not be required to fill their bladder in preparation for the transabdominal examination.

The results of this study show convincingly that even in those women required to undergo a transabdominal study, more urine in the bladder does not equate with a better quality study. Indeed, of the 206 patients in this study, only three (1.5%) required a distended bladder for a complete examination. Furthermore, Benacerraf et al have shown that women who require transabdominal imaging will almost always have a large uterine or adnexal mass.

In my opinion, the most practical approach for gynecologic imaging is as follows. If a women has a known or suspected pelvic mass, an initial transabdominal scan should be done without bladder filling. For complete visualization of the pelvic organs, many, but certainly not all, of these women will require a subsequent transvaginal exam (with an empty bladder). Since most women do not have a large pelvic mass, and since their organs will be better visualized transvaginally, this approach alone will suffice for the great majority of women. ❖

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CT and MR are Equally Accurate and Adequate to Stage Advanced Ovarian Cancer

ABSTRACT & COMMENTARY

Synopsis: *Advanced ovarian cancer can be staged with high accuracy by either computed tomography or magnetic resonance imaging. Ultrasound's lesser accuracy was primarily due to poorer results in imaging peritoneal metastases in the subdiaphragmatic spaces. Whether this limitation can be overcome was not tested in this study and is not yet known.*

Source: Tempany CM, et al. Staging of advanced ovarian cancer: Comparison of imaging modalities—Report from the Radiological Diagnostic Oncology Group. *Radiology* 2000; 215:761-767.

Ovarian cancer is the second most common gynecologic cancer and causes the most deaths. A "silent killer," the five-year survival rate for all stages is 46%, but the survival varies significantly by stage: 93% for localized disease, but 25% for advanced disease. Less than one-quarter of patients present with local disease. Many cases of higher stage disease are only discovered at laparotomy. Accurate preoperative staging by imaging would be of value to assess potential sites for surgical biopsy, to ensure a proper surgical approach to debulking, and to plan referral for appropriate chemotherapy.

Under the auspices of the National Cancer Institute of the National Institutes of Health, the Radiological Diagnostic Oncology Group (RDOG) performed a prospective, multi-institutional assessment of the accuracies of magnetic resonance (MR) imaging, computed tomography (CT), and gray-scale Doppler ultrasonography (US) in the diagnosis and staging of ovarian cancer. Overall diagnostic accuracy for malignancy was not significantly different among the three modalities.[1] Now the group presents an analysis of subdata reflecting key staging sites in patients with advanced disease—Stages III and IV—precisely those patients in whom detailed therapy

planning is needed. (In the 1986 staging system[1] of the International Federation of Gynecology and Obstetrics [FIGO], patients with peritoneal implants outside the pelvis or positive retroperitoneal or inguinal lymph nodes are classified in Stage III while those with distant metastases including malignant pleural effusions or parenchymal liver metastases are Stage IV.)

Tempany and colleagues compared the accuracy of detection of spread of ovarian cancer to 11 individually identified sites in the peritoneum, 10 separate lymph node sites, and the liver parenchyma (lesions on the liver surface were included with the peritoneum). All patients underwent at least two of the three imaging examinations within four weeks of the surgical staging and, when appropriate, debulking. All examinations were performed on high-quality imaging equipment using standardized protocols including intravenous iodinated radiographic contrast material for CT studies and 1.5 Tesla MR systems with imaging before and after intravenous administration of gadolinium-based contrast material. Images were interpreted in a standardized fashion prospectively at each institution by a single (but different) radiologist for each modality. Radiologists rated their degree of suspicion of malignancy at each site. Receiver operating characteristic (ROC) curve statistical analysis was performed for the imaging findings using the results of surgery and histology as proof. The area under the ROC curve, Az, indicates overall diagnostic accuracy.

Of the 280 patients who met the study criteria, 118 had malignancy and 73 (62% of patients with malignancy) had Stage III or IV. Metastases to the peritoneum occurred in 70 patients, to lymph nodes in 20, and to the liver in seven.

For peritoneal metastases, MR and CT were more sensitive than US (95%, 92%, and 69%, respectively), but US was more specific than MR or CT (93%, 80%, and 82%, respectively). ROC curve analysis showed MR and CT superior to US (Az = 0.96, 0.96, and 0.86, respectively). (Some of these comparisons had P values of 0.05, technically not statistically significant at the $P < 0.05$ level typically used as the criterion.) Subgroup analysis showed that the subdiaphragmatic spaces were a key area where CT and MR were superior to US.

For lymph nodes, the Az for MR, US, and CT were 0.76, 0.68, and 0.57, respectively. The values for MR and CT were significantly different; the values for US did not differ significantly from those of either MR or CT. For the liver, the small number of metastases limited the analysis, and overall accuracies as indicated by Az did not differ significantly among the three modalities.

COMMENT BY JAMES H. ELLIS, MD

In the spirit of full disclosure, I must state that I was one of the 15 radiologists who interpreted images for this study and, for a short while, a small amount of my salary was supported (but not supplemented) by my being a co-investigator on this project. I was a co-author of a different paper based on this patient population.[1]

The current study relies heavily on complex statistical analysis for its results. The work was complicated by the logistical inability to obtain all three imaging modalities (MR, CT, and US) in each patient; many patients underwent only two of the three modalities. The result is that pairwise comparisons were not always made on precisely the same populations of patients.

Regardless of these logistical problems, some useful conclusions can be drawn. In patients with advanced stage ovarian cancer due to peritoneal, lymph node, or hepatic metastases, peritoneal metastases are most common as the defining cause of the advanced stage. In the current study of 73 patients with advanced disease, 70 had peritoneal metastases compared to 20 with lymph node metastases and seven with liver metastases. Thus, any imaging technique that is to be used to stage advanced ovarian cancer needs to be able to visualize peritoneal metastases. MR and CT were superior to US in this regard, especially due to the ability of MR and CT to detect subdiaphragmatic peritoneal metastases. Whether now knowing that the subdiaphragmatic region is a weakness of US could lead to more effort and thus better results or whether this is a noncorrectable limitation of US technique is unknown.

Perhaps surprisingly, none of the techniques had high sensitivity in the detection of metastatic lymph nodes (41%, 39%, and 32% for CT, MR, and US, respectively; slightly different numbers are given in a table compared to in the text). Lymph node sizes were not reported; many metastases may have been within nonenlarged lymph nodes. Ultrasound was a relatively close third in sensitivity, compared to what one might typically expect of ultrasonographic evaluation of lymph nodes.

Another finding that might not have been predicted was the success of MR in identifying peritoneal metastases and abdominal (e.g., porta hepatis) lymph node metastases compared to CT even in the absence of bowel contrast agent for MR. Whether an MR oral contrast agent would further improve the accuracy of MR remains to be tested.

Some limitations of the study should be noted. The examinations were performed from 1993 to 1996. All three imaging modalities have undergone technical improvements, particularly CT with multidetector technology (some of the exams were performed in dynamic

mode, others in helical mode). The CT technique was chosen to favor the pelvis over the abdomen: patients were scanned from the symphysis pubis upward. Especially for scanners in dynamic mode, this means that the liver was not imaged during the optimal phase of intravenous contract enhancement. The number of patients with liver metastases was too small (7 patients) to draw any conclusions, perhaps justifying this unorthodox technique. With current faster CT scanners, a technique that does not sacrifice abdominal image quality for pelvic image quality could be used.

MR and CT have high accuracy in staging advanced ovarian cancer and either modality is appropriate. Local factors, such as availability, cost, and patient preference or contraindications, may be important in choosing which one to use. Ultrasound is surprisingly accurate given the need to assess peritoneal implants and lymph nodes. The results of this study could lead to investigation of how ultrasound technique might be improved to overcome its circumscribed deficiency in detecting subdiaphragmatic peritoneal metastases. ❖

Reference

1. Kurtz AB, et al. Diagnosis and staging of ovarian cancer: Comparative values of Doppler and conventional US, CT, and MR imaging correlated with surgery and histopathologic analysis—Report of the Radiology Diagnostic Oncology Group. *Radiology* 1999;212:19-27.

CT Venography Performed as Part of a CT Pulmonary Angiogram for Pulmonary Embolism

ABSTRACT & COMMENTARY

Synopsis: *CT venography performed as part of a CT pulmonary angiogram for pulmonary embolism is equivalent to ultrasound in detection of lower extremity deep venous thrombosis.*

Source: Loud PA, et al. Combined CT venography and pulmonary angiography in suspected thromboembolic disease: Diagnostic accuracy for deep venous evaluation. *AJR Am J Roentgenol* 2000;174:61-65.

This technique, first described in 1998, entails helical CT pulmonary angiography for the evaluation of pulmonary emboli followed by delayed axial CT examination of the lower extremities, pelvis, and inferior vena cava to detect deep venous thrombosis (DVT). The study describes 71 consecutive patients with suspected pulmonary embolism who had CT pulmonary angiography followed 3.5 minutes after the beginning of contrast injection by axial 5- or 10-mm-thick scans from the upper calves to the diaphragms. All patients had bilateral lower extremity ultrasound (US) examinations performed from the popliteal fossa to the inguinal regions within 12 hours of the CT venogram.

The lower extremity ultrasound was normal in 52 patients, with all patients having negative CT venograms. Eighteen patients had positive US studies for DVT in the femoropopliteal system, with all showing thrombus on CT venography. Six of these patients with positive CT venograms showed extension of thrombus into the iliac veins or inferior vena cava (IVC) not evident on US. One patient with an isolated IVC thrombus on CT venogram had a negative lower extremity US examination. When compared to lower extremity US, the sensitivity and specificity of CT venography were both 100%.

COMMENT BY JEFFREY S. KLEIN, MD

Since more than 90% of pulmonary emboli originate from lower extremity DVT and the treatment for proximal DVT is similar to that for pulmonary embolism, there is a strong rationale for deep venous imaging in the evaluation of pulmonary embolism. The noninvasive technique described in this paper takes advantage of the normal delayed venous return of contrast-enhanced blood from the lower extremities and provides a noninvasive evaluation of the deep venous system that requires little additional time (5-7 minutes per patient) and radiation exposure.

Although the results of this study appear promising, the routine implementation of this technique awaits the results of large prospective studies investigating the relative use of CT pulmonary angiography in the evaluation of pulmonary embolism. In addition, the optimal type of scan parameters (i.e., collimation, spacing, axial vs helical acquisition), contrast dose, and timing of lower extremity and pelvic imaging following CT pulmonary angiography will vary between different patient populations and has yet to be determined. However, I believe helical CT will prove to have a high negative predictive value for recurrent thromboembolic disease and since the primary prognostic factor for recurrent pulmonary embolism is residual DVT in the proximal veins, the technique of combined CT pulmonary angiography and lower extremity and pelvic venography will supplant the

ventilation/perfusion scan and become the examination of choice in the evaluation of suspected pulmonary embolism. ❖

FDG PET Limited in Evaluation of Mucinous Tumors

ABSTRACT & COMMENTARY

Synopsis: *Although FDG PET can be useful for evaluation of primary or recurrent neoplasms, tumors containing abundant mucin may have false-negative results at PET.*

Source: Berger KL, et al. FDG PET evaluation of mucinous neoplasms: Correlation of FDG uptake with histopathologic features. *AJR Am J Roentgenol* 2000;174:1005-1008.

Fluorodeoxyglucose positron emission tomography (FDG PET) is becoming an important technique in the evaluation of known or suspected neoplasms, whether primary or recurrent. As experience accrues, however, it is becoming clear that generalizations about the accuracy of PET for the diagnosis of malignancy can be dangerous. Specifically, some low-grade tumors grow slowly and metabolize glucose at relatively low rates, making them indistinguishable from benign processes at PET. Conversely, some inflammatory processes can consume glucose rapidly, and thus falsely simulate malignancy at PET.

In an attempt to better define the capabilities of PET, Berger and associates performed a retrospective review of FDG PET examinations in 22 patients being evaluated for primary (n = 12) or recurrent (n = 10) mucinous carcinoma. The results of PET were correlated with findings at histopathologic examination of core biopsy or surgical resection specimens. Interestingly, PET showed moderately or markedly increased FDG accumulation (relative to surrounding normal tissue or the corresponding normal contralateral structure) in the mucinous carcinoma in only 13 (59%) of the patients. The nine carcinomas showing no or minimal uptake of FDG measured 1-5 cm in diameter on other imaging studies or at pathologic examination; these tumors included recurrent colorectal cancer (n = 5), primary carcinoma of the esophagus/gastroesophageal junction (n = 2), primary lung cancer (n = 1), and metastatic breast cancer (n = 1). Carcinomas with low cellularity or containing abundant mucin were statistically significantly correlated with false-negative PET results. Berger et al conclude that evaluation of mucinous tumors with FDG PET is limited, especially in those tumors that contain abundant mucin and relatively few cells.

COMMENT BY DAVID M. PANICEK, MD

This report provides an important cautionary reminder that the ability to demonstrate cancer at FDG PET examination also depends on the particular histologic composition of a given tumor; not all colon carcinomas, for example, will produce positive findings at PET, even if large. Such information is critical for properly determining the clinical significance of a negative result at PET, to avoid incorrectly concluding that a malignant lesion is benign.

The results of this study are particularly relevant because tumors that produce mucin are not rare, arising in various anatomic sites such as colorectum, stomach, pancreas, ovary, and lung. And, as Berger et al point out, one of the more common clinical applications of PET is for the detection of recurrent colorectal cancer; given that mucinous tumors comprise about 17% of colon carcinomas and that colon carcinoma is quite common, the potential magnitude of false-negative PET scans is substantial.

More clinical experience will be needed before the actual sensitivity of PET is known for various histologic types of various tumors. In the meantime, physicians should be cautious about interpreting a negative result at PET if other imaging techniques (such as CT, MRI, or nuclear scintigraphy) show findings suspicious for primary or recurrent malignancy; additional evaluation, such as with close interval follow-up radiologic examination or even biopsy, may be required. Particular caution is warranted in the subgroup of mucinous tumors. ❖

CME Questions

1. **FDG PET shows low uptake in:**
   a. tumors that contain abundant mucin.
   b. tumors that have high cellularity.
   c. inflammatory lesions.
   d. recurrent tumors.

2. **With respect to obtaining a satisfactory pelvic ultrasound examination in most women, Benacerraf et al suggest:**
   a. a transvaginal scan alone with an empty bladder.
   b. a transvaginal scan with an empty bladder, combined with a transabdominal scan with a distended bladder.
   c. a transabdominal scan alone with an empty bladder.
   d. a transvaginal scan with an empty bladder, combined with a transabdominal scan with an empty bladder.

3. **When a transabdominal scan is done:**
   a. the patient should have a distended bladder.

b. the patient should have an empty bladder.
c. the transvaginal scan should be omitted.
d. the transvaginal scan should be done with an empty bladder, and the transabdominal scan should be done with a distended bladder.

4. What is the important identifying factor of osteochondritis dissecans of the elbow?
a. Fragment completely separated from bone.
b. Fragment covered by cartilage.
c. Presence of synovitis.
d. Presence of contracture.

5. A common cause of acute TIPS occlusion is:
a. small shunt diameter.
b. hypercoagulability of certain patients.
c. technical problems with shunt formation.
d. TIPS-biliary fistula.
e. relatively small porto-systemic gradient.

6. The one-year TIPS patency rates reported in the literature have been:
a. 100%.
b. 10%.
c. 50-70%.
d. 90%.
e. None of the above

7. The most promising new form of TIPS with improved patency rates is:
a. created with PTFE stent-graft.
b. created with PET stent-graft.
c. created with regular self-expandable stents.
d. created with regular balloon-expandable stents.
e. TIPS is only considered a bridge to transplantation with very short patency rates.

8. Which one of the following is true concerning staging advanced ovarian cancer with cross-sectional imaging?
a. The most common reason that a patient is staged as advanced ovarian cancer is the presence of liver metastases.
b. Ultrasound was not accurate in detecting peritoneal metastases in any of the typical locations for peritoneal metastases.
c. MR was significantly lower than CT in accuracy for the detection of lymph node metastases, perhaps due to the lack of an oral bowel contrast agent.
d. The high accuracy of CT and MR in staging advanced ovarian cancer makes either an appropriate technique for this purpose.

9. The percentage of pulmonary emboli that arise from the lower extremity veins is:
a. 10%.
b. 30%.
c. 50%.
d. 70%.
e. 90%.

10. The most important prognostic factor for recurrent pulmonary embolism is:
a. size of original thrombus.
b. severity of pulmonary hypertension.
c. presence of residual thrombus in the deep veins.
d. None of the above

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Preparing for HIPAA: Beef up Your Security

By Mark Hays,
Senior Vice President and CTO, InfoMiners.com and Ingenix Co.

(Editor's Note: This is the second of two articles on increasing data protection and security in physician computer systems.)

The health insurance portability and accountability act of 1996 (hipaa) promises to fuel far-ranging and costly changes in healthcare information technology. Over the next few years, the total cost of HIPAA compliance is likely to exceed the cost of Y2K updates—with significant upgrades to existing software and extensive consulting services.

Security for patient information is a key element of HIPAA, which will create a much-needed standard for confidentiality nationwide. Penalties for unauthorized disclosure of patient data start at $50,000 and/or one year in prison. If you work with patient records, these strict new laws will apply to you.

In this article, we'll review important steps you can take today to prepare for HIPAA compliance. These solutions will also deliver immediate benefits—including improved privacy for your patients and reduced legal and financial risk for you and your organization.

Here are some steps you can take now to protect your existing computer systems and databases:

1. **Install password protected "secure desktop" software on every PC.** Your existing PCs are probably the weakest link in your security chain. When your staff leaves for lunch, how many systems are left behind—running, logged in, and ready for anyone who happens to walk by? If a PC is left unattended, "secure desktop" software will automatically time-out to a password protected screen-saver. Centrally managed solutions are available from a number of vendors, including the Zero Administration kit from Microsoft for Windows 98, NT, and 2000.
2. **Mandate more effective password control.** Passwords are often managed for user convenience, not security. Educate your users on the fundamental importance of passwords, and implement new procedures to 1) automatically create complex passwords that cannot be guessed easily, and 2) refresh all passwords frequently.
3. **Explore purchase of a single sign-on system.** If your users need to access a number of different systems with different passwords, take a serious look at single sign-on systems. These solutions aren't cheap or easy to install, but without one, it's extremely difficult and time-consuming to maintain user accounts and passwords in a secure environment. And your users will thank you for the convenience of a single password.
4. **Talk to your vendors about improved security.** Make sure you've fully implemented the security functions included in your existing systems. With HIPAA on the horizon, your vendor probably has improved security functions in the works, including central password and "rights" management. Ask about their plans for HIPAA compliance.
5. **Improve protection for "open" databases.** Audit your facility and find every database that contains patient information, focusing on systems that use a standard "open" database that supports SQL and/or ODBC (e.g., Microsoft Access, SQL Server, Oracle, Paradox, Informix, Btrieve, etc.). Larger organizations often find that dozens of databases have popped up here and there to support departmental applications, local reporting, etc.—and they're rarely

secure. Try to move these databases to "hardened" and secure servers that are centrally managed, and physically protected. If a database must remain in a departmental office, it should be moved to a hardened server that is centrally managed, with some form of physical security. You may also find that this a good time to retire departmental reporting systems, and create a shared data warehouse. Your users will be able to run their standard reporting tools, but the data will be stored in a more efficient and protected environment.

6. **Install a central PC management system.** If your organization has more than a dozen PCs, this is the most important step you can take toward effective security. Your security plan will fail if the PCs on your network are uncontrolled. Central management systems for hardware, operating systems, and software are available from a number of leading vendors, including Microsoft and Computer Associates.

   For many organizations, this is a big step—your users probably treasure the independence they feel with "their" PC, and will be loath to surrender control. Your IT team should be thoroughly trained before you start. Make sure your IT department is staffed to handle new management issues, and take the time to inform and educate your user community.
7. **Lock down external access routes.** Find and document every modem and modem-compatible phone line that users can access. Ban any type of access that doesn't go through your secure servers, filters, and firewalls. This should be backed by strict enforcement.

Secure your E-mail Services

E-mail is the most widely used application on the Web, and the least secure. Take immediate steps to lock down e-mail applications, and monitor e-mail traffic. Here's how.

1. **Clarify your e-mail policy.** Many employers don't have an effective e-mail policy, and recent court cases underscore the risk of inaction. Review and update your policy, notify your employees, and post a copy on your Intranet site. For an example of a good e-mail policy with legal background on key issues, see: www.mlb.com/art61499.htm.
2. **Train and remind your employees and users.** Publish a weekly bulletin to every e-mail user, noting new e-mail virus threats, attachments to avoid, and e-mail policy issues. Add a similar "bulletin" section to your Intranet site, in a prominent location. This will help to keep security concerns fresh in your user community. Automated systems will help you manage this process—see the list below.
3. **Require e-mail encryption, particularly for physicians working with patient data.** It's easy to make e-mail secure with off-the-shelf encryption products. This is essential for physicians who use e-mail to contact patients, consult with colleagues, etc. Solutions include add-ons for common e-mail products (e.g., Outlook and Eudora) and complete e-mail systems with secure clients and servers—see the list below.

   Notify your physicians, spell out the Health Care Financing Administration requirements, and remind them with regular e-mail bulletins. If you have a Web site or an Intranet page specifically for physicians, add a prominent "security for patient data" section, with the latest information. Include the ability to download an encryption add-on for popular e-mail packages, at no charge. Offer special training sessions for physicians to explain the threats and solutions.
4. **Install an automated e-mail encryption/monitoring system.** This is one of the most important steps you can take to secure your entire network—every healthcare organization should install a system that will automatically encrypt e-mail, scan for attached viruses, filter spam and objectionable content, etc. Some will also help you define and your e-mail policy, train users, distribute bulletins, etc. Here are four highly rated solutions:

   MIMEsweeper—www.us.mimesweeper.com/products/websweeper/index.htm

   CommandView—www.elronsoftware.com/enterprise/message_inspector.htm

   MailMarshall—www.cleane-mail.com/

   MailGuardian—www.vguard.com/index.asp

   Also take a look at a recent review of e-mail management products:
   www.check mark.com/securecomputing/2000_03/testc/prod1.html

Secure Your Access to the Web

1. **Clarify your policy for Web use.** Like e-mail, many employers don't have an updated policy for Web use. Review and update your policy, notify your employees, and post a copy on your Intranet site. The example provided on the previous page for e-mail also includes terms for Web use: www. mlb. com/art61499.htm.
2. **Train and remind your employees and users.** Most users are aware of viruses in e-mail, but many do not know that malicious Web sites can launch an attack directly through your Web browser—without open-

ing an "attachment" or clicking on anything. Explain the risks and the importance of updating the version of the Web browser they use.

3. **Require use of a standard "managed" Web browser, particularly for physicians working with patient data.** This is one of the most important steps you can take to improve security in your organization—require the use of the latest version of your Web browser, and provide automated updates.

In larger facilities, this won't be easy. A full update to a new browser release may require a CD—the files are typically 30+ megabytes and difficult to download. The new browser may also require end-user training. Patches to security holes must be applied regularly. Bottom line: although the Web is the most convenient and cost-effective way to provide access to patient data, management of secure Web browsing isn't convenient. Check these support sites for the latest information on Microsoft and Netscape browsers:

Internet Explorer:
www.microsoft.com/windows/ie/security/default.asp

Netscape: www.netscape.com/download/index.html

4. **Install an automated monitoring and content management system for Web use.** This is one of the most important steps you can take to secure your entire network—every healthcare organization should install a system that will automatically track, scan, and filter Web traffic for nonbusiness use and malicious or objectionable content, etc. Some will also help you define and update your policy for Web use, train users, distribute bulletins, etc. Note two highly rated Web content management solutions:

WebSweeper—www.us.mimesweeper.com/products/websweeper/index.htm

SurfControl—
www.surfcontrol.com/products/index.html

Also take a look at a recent review of Web content issues and management products in the March 21, 2000, issue of *Network Computing* at: www.networkcomputing.com/1103/1103f2.html.

5. **Install high-quality firewall and intrusion detection systems.** You probably have a firewall system in place to protect the link between your network and the Web. When you audit your facility, make sure this system is up to date. Firewall technology is constantly changing to meet new threats, and if your firewall is more than a year old, you should take a close look at a major upgrade or replacement. Also check to see if your IT staff is fully trained on firewall management.

If you have a larger facility linked to the Web, but don't have an "intrusion detection" system, add one immediately. Intrusion detection servers monitor the activity on your network automatically—and watch for unusual events that could signal a break-in. Although not perfect, this final line of defense should be a critical part of your Web strategy. For a review of issues and products, see this article from *Network Computing* magazine: www.networkcomputing.com/1010/1010r1.html.

6. **Install a Virtual Private Network for links to sensitive patient data.** For links to patient information, you should provide another layer of protection. Virtual Private Network systems (VPNs) create a "private line" over the public Internet. Data are encrypted during transmission, and special software is required on both ends to make a connection. This separates your links to patient information from ordinary Web traffic. VPN systems also support digital certificates and more effective user ID—both key requirements in pending HIPAA regulations.
7. **Evaluate biometric ID systems.** One of the basic challenges with security is the identification of the user. If the PC is inside your facility, you have greater control. If someone is dialing in via the Internet, how can you identify the person on the other end of the line? Ordinary passwords? This is hardly effective and difficult to manage. Biometric ID systems take the next step, and ID the user based on a fingerprint, iris pattern, etc. This provides much tighter control over authorized access—and eliminates the hassle and cost of password management. User ID is a key requirement with HIPAA, and biometric systems should be part of your plan.
8. **Upgrade security training for your IT staff.** This basic step is often overlooked. Web security is complex and changes rapidly. Your plan should include a significant amount of security training for an "IT Security Team," with refresher courses throughout the year. I recommend at least one class per quarter for each person. These courses are often costly, by the way, so make sure you leave room in your budget.
9. **Consider outsourcing Web security functions.** If your organization doesn't have the resources to handle the daunting challenges of Web security, don't despair—and don't try to "make do." One of the beauties of the Web is the ability to outsource. Your secure Web server could be installed at your site, or 1000 miles away. Users can't tell, and they'll often receive faster Web access than you could provide from your own facility.

Outsourcing eliminates the need to install and maintain complex security hardware and software,

hire additional staff (a real challenge in this economy), and support security technology. From a management point of view, it's often easier for a third party to introduce and control user access—an irate physician who doesn't want to change his or her Web browser, for example, can't pressure your IT staff. It's out of their hands.

Steps You can Take to Prepare for HIPAA

Here are the key steps to take to prepare for implementation of HIPAA.

1. **Implement basic security improvements.** All of the steps outlined previously will improve security and reduce your legal exposure today, and put you well on the road to HIPAA compliance.
2. **Audit your facility. Launch a general security audit of your entire facility.** As you examine your existing systems and procedures, keep HIPAA compliance in mind. Note obvious problems and potential deficiencies, and build a comprehensive plan.
3. **Launch discussions with your existing vendors.** Legacy information systems will be one of the most difficult areas of compliance. Many of these systems were never designed with high-level security in mind, and changes will be difficult. When patient data are transmitted, they are not well protected, databases are not encrypted, password systems are weak and typically do not include audit trails, and no authentication/non-repudiation is provided for data access. Launch discussions with your vendors as soon as possible to uncover their plans for compliance—and the costs you should expect to pay. Many will probably require major system upgrades.
4. **Hire expertise.** Security technology is notoriously complex, and most healthcare organizations simply don't have the resources or training required. Hire a well-qualified security consultant now to prepare your HIPAA plan before compliance becomes a concern.
5. **Keep an eye on those HIPAA Web pages.** The current proposals haven't been finalized, and the federal Department of Health and Human Services received a flood of comments from the industry. As you'll see on the DHHS "HIPAA Schedule" site noted on page 11, the projected dates for release of the "final" rules have been pushed back. Modifications to the proposed rules are expected.
6. **Focus on your current financial risk.** As we noted at the beginning, don't allow the interest in HIPAA to overshadow the basic issues: the patient data you're responsible for are often protected by law, and you face a real risk of legal and financial liability—today. Many of the HIPAA requirements simply reflect good security practice that everyone should implement, with or without federal regulation. Get started today.

(*Mark Hays has more than 15 years of experience with security technology and has coauthored a number of patents for secure software. He received a first place award from Bill Gates for the Best Healthcare Application for Windows, and a First Place in Healthcare/Biotechnology at Uniforum. He is senior vice president of product development and CTO for InfoMiners.com, where he directs development of secure Web-based data warehouse and reporting systems, and other solutions for HIPAA compliance*.)

For quick access to the Web sites listed in this document, go to: www.infominers.com. ❖

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Effect of Obesity on Screening Mammography