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Role of MRI in Characterization of Adnexal Lesions

The strength of MRI is its ability to characterize ovarian lesions, especially in the case of masses that are indeterminate on US. Dynamic contrast-enhanced T1W images are useful for the evaluation of complex adnexal lesions, as they may help differentiate solid components or papillary projections from clots and debris**.** Diffusion weighted imaging (DWI) can help in differentiating malignant from benign ovarian tumors and is useful in detection of peritoneal implants and metastatic lymph nodes in patients with gynecological malignancies.

The signal intensity characteristics of ovarian masses can lead to a systematic approach to diagnosis. The signal intensity of a specific tumour depends on the presence, type and extent of cystic and solid components within a lesion. Lesions that have a homogeneous low signal intensity on T1W images and high signal intensity on T2W images are simple fluid filled structures and are considered benign. In general, benign epithelial ovarian neoplasms are predominantly cystic. Fat, hemorrhage and mucin-containing lesions have high signal intensity on T1W images. Fat-saturated T1W images help distinguish between hemorrhage and fat within a lesion (e.g., endometriosis versus mature cystic teratoma). An adnexal mass of low or intermediate signal intensity on T1W images and low signal intensity on T2W images contains fibrosis and smooth muscle components. Such lesions include pedunculated leiomyoma, fibroma, fibrothecoma, cystadenofibroma and Brenner tumours. The absence of a normal ipsilateral ovary or the presence of small follicles surrounding the mass helps identify the ovarian origin of fibromas.

It is important to recognize that as there are no MRI signal intensity characteristics that are specific for malignant epithelial tumor, such tumors must be distinguished based on morphologic criteria. The MRI features most predictive of malignancy are an enhancing solid component or vegetations within a cystic lesion, presence of necrosis within a solid lesion as well as presence of ascites and peritoneal deposits. The presence of at least one of the primary criteria and an additional single criterion from the ancillary group correctly characterizes 95% of malignant lesions. Both transvaginal US and contrast-enhanced MRI have high sensitivity (97% and 100%, respectively) in the identification of solid components within an adnexal mass. MRI, however, shows higher accuracy (93%).

MRI cannot confidently differentiate between specific surface epithelial, germ cell, stromal cell or metastatic tumors. However, it is possible to suggest the histologic subtype of the epithelial cancer based on the imaging findings. *Serous cystadenocarcinomas* are frequently bilateral and usually appear as mixed solid and cystic masses with irregularly shaped solid components. The solid components show avid enhancement and areas of necrosis. These appearances in combination with a disproportionately large amount of ascites compared to the tumor size, presence of enlarged lymph nodes and peritoneal and/or serosal implants are suggestive of diagnosis. *Mucinous cystadenocarcinomas* tend to be larger in size, more often unilateral and occur in an older age group. They are usually multiloculated and may be of higher signal intensity on T1W images due to high protein concentration within the mucinous material. Presence of ascites and peritoneal implants is rare. *Clear cell carcinoma* accounts for only 5% of ovarian cancers and it is almost invariably malignant. It is associated with endometriosis in 30-35% of cases. The diagnosis should be considered when a nodule is seen within a predominantly cystic endometrioma. *Endometroid carcinomas* are usually bilateral and associated with endometrial hyperplasia or carcinoma in 20-30% of cases and endometriosis in 15-20% of cases. They are mainly solid with areas of necrosis and avid enhancement.

Currently, the main role of MRI is characterization of ovarian masses rather than staging of histologically proven ovarian cancer. Peritoneal dissemination is the most common route of spread of ovarian cancer. Peritoneal implants appear as nodular or plaque-like enhancing soft tissue masses of varying size. MRI is very sensitive (95%) for detection of peritoneal metastases, which show delayed enhancement on contrast-enhanced MRI. Ascites is a non-specific finding but, in a patient with ovarian cancer, usually indicates peritoneal metastases. Ascitic fluid may outline small implants, facilitating detection. Peritoneal implants may occur anywhere in the peritoneal cavity, but the most common sites include the pouch of Douglas, paracolic gutters, surface of the small and large bowel, greater omentum, surface of the liver (perihepatic implants) and subphrenic space. MRI is useful in differentiating between subcapsular liver implants and parenchymal liver metastasis, which alters staging and therapy. These implants are best seen on the delayed (5-10min) contrast-enhanced images and DWI.

References

1. Jeong YY et al. Radiographics 20:1445-1470, 2000.
2. Hricak H et al. Radiology 214:39-46, 2000.
3. Tempany CM et al. Radiology 215:761-767, 2000.
4. Low RN et al. Radiology 235:918-926, 2005.
5. Fujii S et al. Eur Radiol 18:18-23, 2008.