

ORIGINAL ARTICLE

Diagnostic value of abdominal CT scan in ovarian tumors in Dr. Soetomo General Academic Hospital, Surabaya, Indonesia, from January 2017 to December 2018Ida Bagus Gede Ramayuda^{1*}, Lies Mardiyana¹, Dyah Erawati², Indra Yuliati²¹Department of Radiology, Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia,²Department of Obstetric and Gynecology, Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia**ABSTRACT**

Objectives: The purpose of this study was to determine the diagnostic value of contrast-enhanced abdominal CT scan in ovarian tumors in Dr. Soetomo General Academic Hospital, Surabaya, Indonesia, to provide scientific and clinical benefits.

Materials and Methods: Samples were taken retrospectively by contrast-enhanced abdominal CT scan raw data in Dr. Soetomo General Academic Hospital, Surabaya, Indonesia, from January 2017 to December 2018. Using inclusion and exclusion criteria, a total of 88 samples were obtained and reviewed blindly by Female Organ Division of Radiology Department, Faculty of Medicine Universitas Airlangga, and by using "tools" (primary and additional findings of modified ovarian tumors malignancy). The data were correlated with histopathological findings and analyzed by statistical tests and the results with and without "tools" were compared.

Results: Samples were grouped by age, distributed with a range of 20 years and the group of 41-60 years had the highest age of ovarian tumor samples (46.6%) with 84.1% being ovarian malignant tumors according to their histopathological results. It was dominated by serous, mucinous and endometrioid types with sensitivity of 93.3%, specificity of 64.3%, positive predictive value of 93.3% negative predictive value of 69.2%, and accuracy value of 89.8%. More reliable results were obtained by using "tools".

Conclusion: Contrast-enhanced abdominal CT scan of ovarian tumors in Dr. Soetomo General Academic Hospital, Surabaya, Indonesia, evaluated by "tools" still had a better and more reliable diagnostic value than without tools in determining policy steps in handling ovarian tumors with a note that more in-depth research on pitfalls is needed so it may enrich the characteristic findings in imaging.

Keywords: abdominal CT scan; ovarian tumor malignancy; histopathology; primary and additional findings; cancer; maternal health; medicine

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ABSTRAK

Tujuan: Tujuan penelitian ini adalah untuk mengetahui nilai diagnostik pemeriksaan CT scan abdomen dengan kontras pada tumor ovarium di RSUD Dr. Soetomo, Surabaya, Indonesia, sehingga memberikan manfaat ilmiah maupun klinis.

Bahan dan Metode: Sampel diambil secara retrospektif melalui raw data CT scan abdomen dengan kontras di RSUD Dr. Soetomo, Surabaya, Indonesia, antara Januari 2017 hingga Desember 2018, dengan membuat kriteria inklusi dan eksklusi didapatkan sampel sejumlah 88 dan direview oleh divisi female organ Departemen Radiologi FK-Unair-RSUD Dr. Soetomo secara blind dan menggunakan "tools" (temuan primer dan tambahan keganasan tumor ovarium termodifikasi) kemudian dikorelasikan dengan temuan histopatologinya dan dianalisa dengan uji statistik serta hasil yang diperoleh dengan dan tanpa "tools" diperbandingkan.

Hasil: Sampel dikelompokkan berdasarkan umur, didapatkan distribusi dengan rentang 20 tahun dan kelompok 41-60 tahun menunjukkan umur sampel tumor ovarium terbanyak (46,6%) dengan 84,1 % merupakan tumor ganas ovarium sesuai hasil histopatologinya. Didominasi oleh keganasan jenis serous, mucinous dan endometrioid. Didapatkan sensitivitas 93,3%, spesifisitas 64,3%, nilai duga positif 93,3% nilai duga negatif 69,2%, dan nilai akurasi 89,8% yang hasilnya lebih baik dengan menggunakan tools.

Simpulan: Pemeriksaan CT scan abdomen dengan kontras pada tumor ovarium di RSUD Dr. Soetomo serta dievaluasi menggunakan tools masih memiliki nilai diagnostik yang lebih baik dan dapat diandalkan dibandingkan tanpa tools dalam menentukan langkah kebijakan dalam penanganan tumor ovarium dengan catatan diperlukan penelitian yang lebih mendalam terhadap timbulnya pitfalls sehingga dapat menambah karakter temuan dalam pencitraan.

Kata kunci: CT scan abdomen; keganasan tumor ovarium; histopatologi; tools; kanker; kesehatan ibu; perawatan

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INTRODUCTION

Malignancy of ovarian tumors is the 7th most common cause of death in women by cancer, after breast, lung, colorectal, cervical, gastric, liver and pancreatic cancers with 4.4% of 4.2 million deaths from cancer and having an incidence of 3.4% of the 8.6 million new cases in the world.¹ Identifying and assessing the characteristics of ovarian tumor malignancy and female pelvic malignancy is very important before a laparotomy plan is carried out and also associated with 5-year life expectancy in the patients.² Contrast-enhanced abdominal CT scan can help clinicians to strengthen diagnostic enforcement of ovarian tumor malignancies before cyto-reduction surgery is performed. Contrast-enhanced abdominal CT scan still a valid tool with good sensitivity and specificity. CT scan provides more extensive and important information in case of gynecological malignancies both as staging determinants and plans for managing the disease. Comprehensive and uniform criteria will increase the diagnostic value of CT scan in ovarian tumors especially in Dr. Soetomo Hospital, Surabaya, Indonesia, and referred to the gold standard diagnostic by histopathological examination.^{4,5}

MATERIALS AND METHODS

This study was approved by the Medical Research Ethics Committee of Universitas Airlangga/Dr. Soetomo General Academic Hospital, Surabaya, Indonesia. The design of this study was retrospective observational analytic design. There were 213 cases, but most did not have representative histopathological results and incomplete abdominal CT documents. After obtaining inclusion and exclusion criteria, there were 88 cases that met the researcher requirements for sample with the youngest age of 7 years and the oldest age of 79 years. The patients were divided into age groups with a range of 20 years. The results showed that most ovarian tumor patients were in the age group of 41-60 years, namely 46.6% (41 people), 29.5% (26 people) in the age group of 21-40 years, 13.6% (12 people) in the age group of 61-80 years, and 10.2% (9 people) in the age group of 1-20 years. The inclusion criteria were clinical patients suspected of ovarian tumors who had performed contrast-enhanced abdominal CT scan before surgery, raw data of CT scan, and histopathological examination results from January 2017 to December 2018. Exclusion criteria included all who were not included in the inclusion criteria, tumor evaluation (restaging) and prior chemotherapy. All data were collected on contrast-enhanced abdominal CT scan which blindly reviewed by the female organ division of the Radiology Department of Universitas Airlangga

using modified "tools" that contain primary findings on CT scan (mass size, septation, septal thickness, cystic component, solid, fat, calcification, contrast enhancement, papillary projection, ovarian artery feeding) and additional findings (ascites, peritoneal implants, lymph node enlargement, normal uterus that could still be identified and the absence of another organ mass). The effectiveness of the diagnostic value with and without the tools was also be compared.

The examination used a 16-slice CT scan machine of the Hitachi brand ECLOS Q1E-BW1545-1 and Siemens SOMATOM Emotion 80476. Abdominal CT scan used non-ionic, water soluble contrast agent of Iopamiro 370 with a dose of 1-1.5mm/body weight and made according to the protocol of Pelvic abdominal CT scan. Raw data of abdominal CT scan was reformed with a thickness of 2 mm. The data was then reviewed using the DCOM file reader application by Female Organ Division of the Radiology Department of the Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia.

Data analysis was performed with Friedman test using SPSS to obtain diagnostic values in the form of sensitivity, specificity, positive and negative predictive values along with accuracy and precision of data. For statistical analysis, the findings of the review results using "tools" was cross tabulated with histopathological findings.

RESULTS AND DISCUSSION

The results of the comparison test using Friedman test between histopathological examination as the gold standard with CT scan showed p-value of 0.739 ($p > \alpha$).

Table 1. Cross tabulation between abdominal CT scan with histopathological examination in ovarian tumor patients with tools in Radiodiagnostic Installation of Dr. Soetomo General Academic Hospital, Surabaya, Indonesia, during January 2017 - December 2018

		Histopathology		Total
		Malignant ovarian tumor	Benign ovarian tumor	
Ct scan	Malignant ovarian tumor	TP :70	PF:5	75
	Benign ovarian tumor	NF:4	TN:9	13
Total		74	14	88

Sensitivity: 93.3%, Specificity: 64.3%, Accuracy: 89.8%, Precision: 93.3%, Recall: 64.3%, Negative predicting value: 69.2%, Positive predicting value: 93.3%

There was no difference between the results of histopathological examination and the results of abdominal CT scan. So the abdominal CT scan was as good as histopathology with a sensitivity value of 93.3% and a specificity of 64.3%. To assess the accuracy of the abdominal CT scan compared to the histopathological results obtained an accuracy value of 89.8%, precision of 93.3%, recall of 64.3% NPV of 69.2%, and PPV of 93.3%.

Table 2. Cross tabulation between abdominal CT scan with histopathological examination in ovarian tumor patients without tools in Radiodiagnostic Installation of Dr. Soetomo General Academic Hospital, Surabaya, Indonesia, during January 2017 - December 2018

		Histopathology		Total
		Malignant ovarian tumor	Benign ovarian tumor	
Ct scan	Malignant ovarian tumor	TP:61	PF:9	70
	Benign ovarian tumor	NF:14	TN:4	18
Total		75	13	88

Sensitivity: 87.1%, Specificity: 22.2% Accuracy: 73.8%, Precision: 87.1%

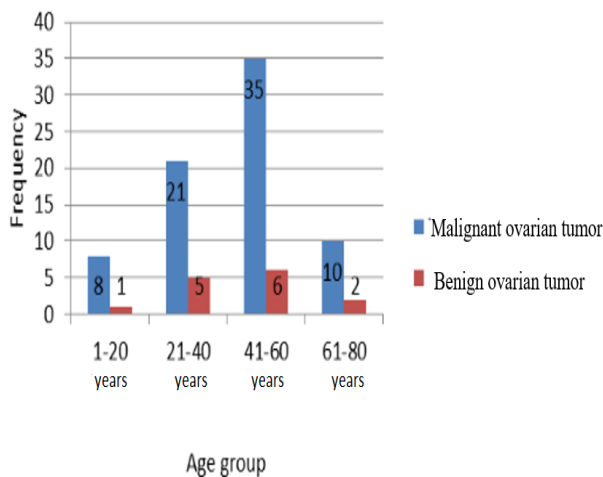


Figure 1. Bar chart of patient's age with malignant and benign findings of ovarian tumors according to histopathology results in Radiodiagnostic Installation of Dr. Soetomo General Academic Hospital, Surabaya, Indonesia, during January 2017 - December 2018

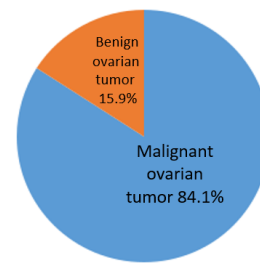


Figure 2. Circle chart of histopathological examination of ovarian tumor patients in Radiodiagnostic Installation of Dr. Soetomo General Academic Hospital, Surabaya, Indonesia, during January 2017 - December 2018

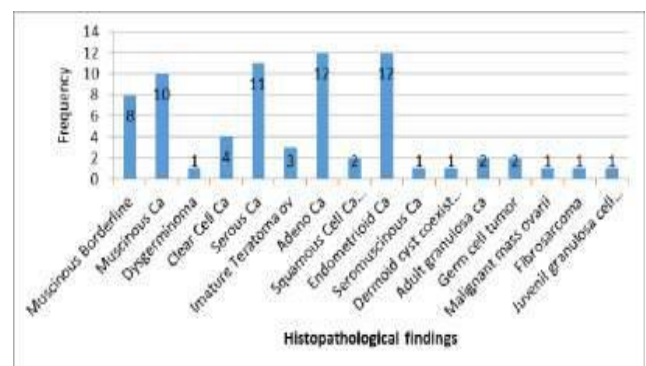


Figure 3. Bar chart of histopathological findings of patients with malignant ovarian tumors in Radiodiagnostic Installation of Dr. Soetomo General Academic Hospital, Surabaya, Indonesia, during January 2017 - December 2018

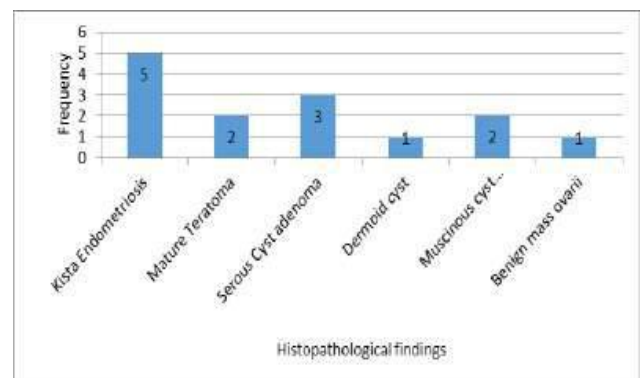


Figure 4. Stem distribution diagram of histopathological findings of patients with benign ovarian tumors in Radiodiagnostic Installation of Dr. Soetomo General Academic Hospital, Surabaya, Indonesia, during January 2017 - December 2018

Table 3. Primary findings of abdominal CT scan in ovarian tumor patients in Radiodiagnostic Installation of Dr. Soetomo General Academic Hospital, Surabaya, Indonesia, during January 2017 - December 2018

Primary findings of abdominal CT scan		Frequency	Percentage (%)
Lesion size > 4cm	Yes	87	98.9
	No	1	1.1
Septated	Yes	71	80.7
	No	17	19.3
Septa thickness > 3mm	Yes	71	80.7
	No	17	19.3
Cystic	Yes	86	97.7
	No	2	2.3
Solid	Yes	83	94.3
	No	5	5.7
Fat	Yes	12	13.6
	No	76	86.4
Calcification	Yes	16	18.2
	No	72	81.8
Contrast enhancement	Yes	81	92
	No	7	8
Papillary projection	Yes	35	39.8
	No	53	60.2
Feeding artery ovarica	Yes	72	81.8
	No	16	18.2

Table 4. Additional findings of abdominal CT scan in ovarian tumor patients in Radiodiagnostic Installation of Dr. Soetomo General Academic Hospital, Surabaya, Indonesia, during January 2017 - December 2018

Primary findings of abdominal CT scan		Frequency	Percentage (%)
Ascites	Yes	39	44.3
	No	49	55.7
Peritoneal implant	Yes	5	5.7
	No	83	94.3
Enlargement of pelvic lymph node	Yes	23	26.1
	No	65	73.9
Mass of other organs	Yes	1	1.1
	No	87	98.9
Normal uterus identified	Yes	85	96.6
	No	3	3.4

This study had 213 cases of ovarian tumor, but most did not have representative histopathological results and incomplete abdominal CT documents and after obtaining inclusion and exclusion criteria, there were 88 cases that met the researcher requirements for analysis. Furthermore, it had the youngest age range of 7 years and the oldest of 79 years with an average age of 43.73 ± 16.02 years so the range was fairly representative as sample, with 46.6% of malignant ovarian tumors in the group age of 41-60 years. It was in accordance with the Kooning PP study in 1989⁶ and the National Cancer Institute report which states that ovarian carcinoma occurs most often at the age above 40 years.⁷ Most of the lesion had size of more than 4 cm (98.9%),

indicating that the character of the tumors was not in the initial phase (Figure 5A).

There were 80.8% of ovarian epithelial tumors which were dominated by mucinous carcinoma, adenocarcinoma and endometrioid carcinoma or about 84.1% of malignancies in ovarian tumors. This finding was still lower than the finding of 85% in Koonings PP et al, 1989.⁶ The presence of 13.6% fat and 18.2% calcification components showed that lesions with these components originated from germ cell tumors around 10.6%. The increase of contrast enhancement in ovarian tumors is a primary finding that leads to malignancy.³ This study found that 92% of the samples showed an increase in contrast enhancement (Figure 5C). Papillary projection as a form of protrusion of solid components in complex ovarian cysts leads to a malignancy process (Figure 5D).⁸ This study was found that only 39.8% of the samples were described as papillary projection. Kamel (2011) found that 30% of papillary were malignancy in 78% of the sample.⁹

The existence of tumor from an organ can be established by knowing the origin of feeding the arteries that supply nutrients to the mass. Ovarian mass obtains feeding from ovarian arteries, sometimes it can also get an anastomosis from the uterine artery branch because of its anatomic position, so we can still obtain a profile of ovarian mass that seemingly obtains feeding from the uterine artery (Figure 6A). In addition to the primary findings that lead to the malignancy of ovarian tumors, there are also additional findings on contrast abdominal CT scan. These additional findings will strengthen the primary findings towards malignancy. The most common additional finding in this study was ascites, found as many as 44.3% of the sample (Figure 6B). This was similar to the findings of Nimwegen¹⁰ who found that ascites had the same chance of arising in malignant and benign ovarian tumors, so that ascites was not categorized as the primary finding for ovarian tumors.

Peritoneal implants also serve as additional findings in establishing malignancy of an ovarian tumor which indicates the presence of metastases in the peritoneal wall.¹¹ In this study, it was only 5.7% that were found. This low number was due to the limitations of CT scans to detect the presence of peritoneal lesions of less than 0.5 cm (Figure 6C). Another additional finding referred to the malignancy of an ovarian tumor on CT scan is lymph node enlargement in the pelvis. The amount of ovarian mass in the later phase of the disease also affects the findings of lymph node enlargement because the mass obscures it. Abdominal CT scan also has limitation showing objects smaller than 0.5 cm. These two make lymph node enlargement difficult to evaluate. In this study, 26.1% of the samples were identified with lymph node enlargement in the pelvis (Figure 6D).

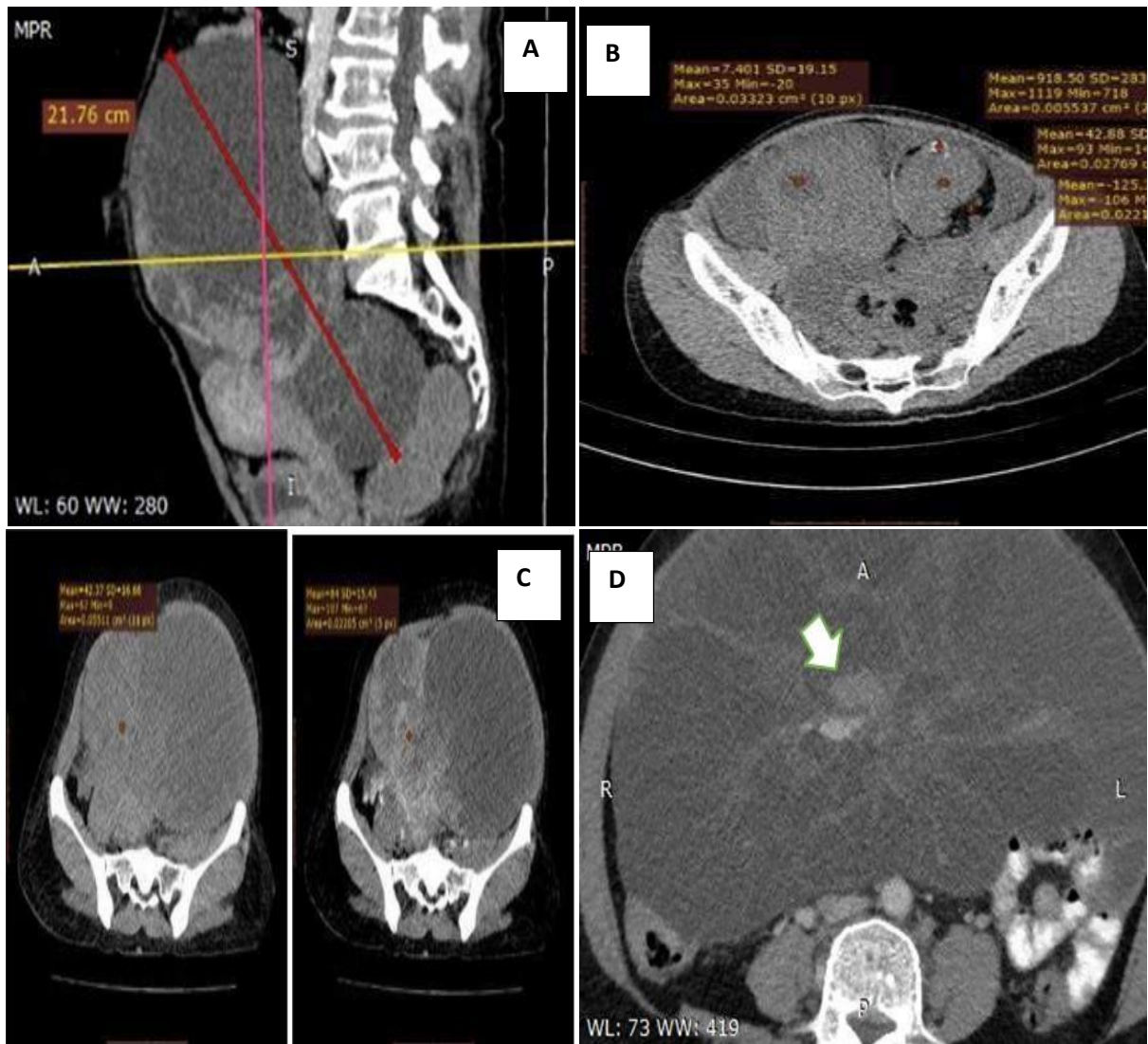


Figure 5. A. Sagittal contrast-enhanced abdominal CT scan, 71-year-old woman with cystic septated mass with the largest size of 21.7 cm which is clear cell carcinoma ovarium on histopathological examination. B. Abdominal CT scan of a woman aged 19 years with the finding of a pelvic mass with calcified, fat, solid and cystic components, on histopathological examination, it was concluded as immature teratoma ovary. C. Examination of contrast-enhanced abdominal CT scan, a 39-year-old woman showed a pattern of increased contrast enhancement in her solid lesions which found as poorly differentiated adenocarcinoma in histopathological examination on adnexa. D. Abdominal CT scan examination of 55-year-old shows a large cystic septated mass with papillary projection (arrow) in the central of the lesion. It was confirmed as mucinous grade II ovarium on histopathological examination.

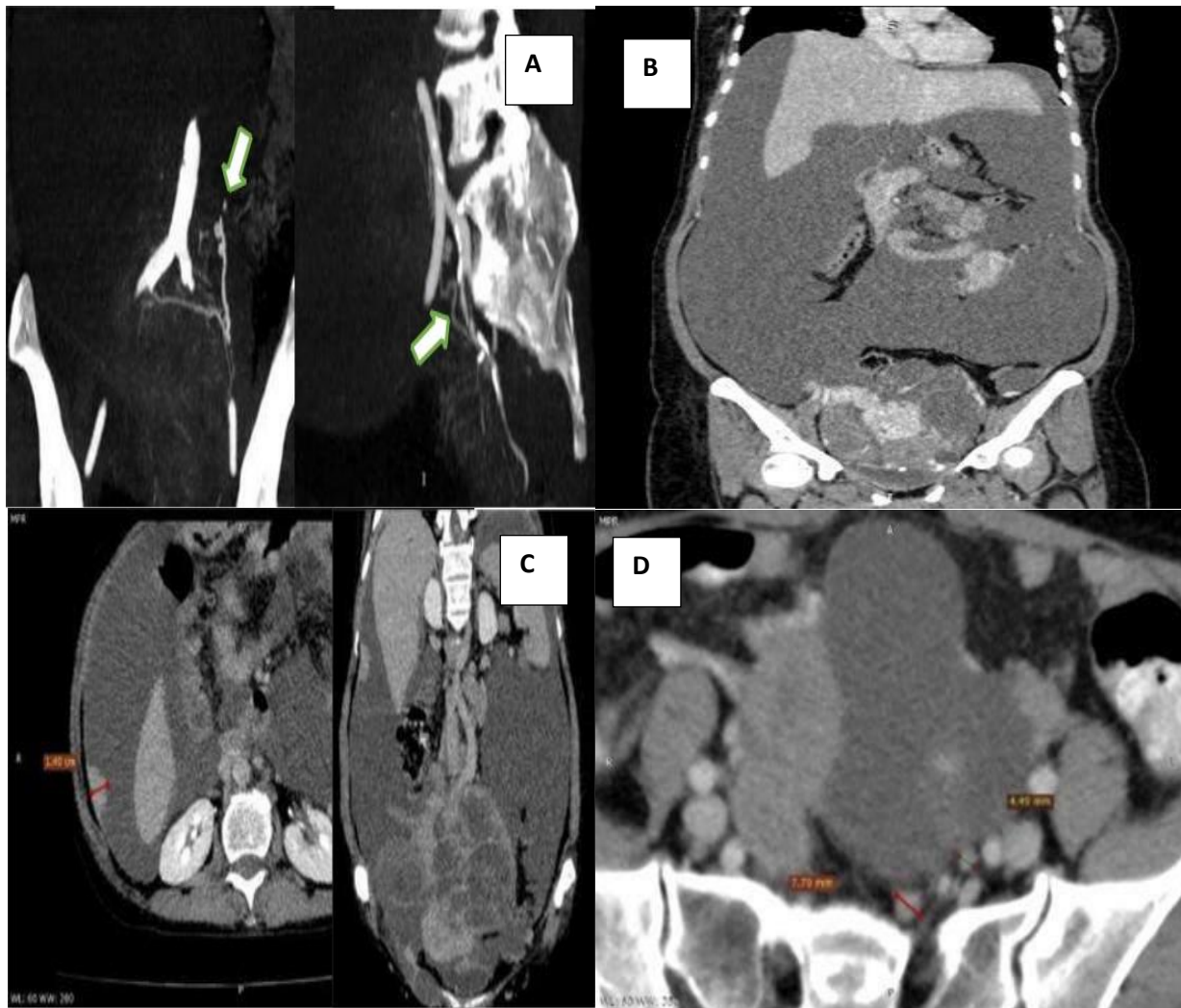


Figure 6. A. Coronal and sagittal abdominal CT scan examination, a 70-year-old woman with a pelvic mass that extends to the abdomen get feeding from the left ovarian artery (white arrow), histopathological examination suggestive of endometrioid carcinoma of ovary. B. Coronal contrast-enhanced abdominal CT scan, 34-year-old woman with serous carcinoma ovary grade II shows ascites that fills the abdominal cavity. C. Axial and coronal contrast enhanced abdominal CT scan of 60-year-old female, shows the presence of ascites with peritoneal implants on the right side lateral abdominal wall which on histopathology examination showed as high grade endometrioid carcinoma. D. Axial abdominal CT scan pelvis showing lymph node enlargement in the pelvis in a 52-year-old female patient of adenocarcinoma ovary.

Finding of mass in other organs should be suspected that the mass in the pelvis is a part or mass expansion of the organs. In this study, 1.1% or 1 sample was found in the presence of a mass in other organ which indicated that the mass in the pelvis was part of the organ (Figure 7A) as stated by Meissnitzer (2012) about abnormalities of other organs that resemble ovarian tumor.¹² Regarding the evaluation of the mass other than adnexa in the diagnosis of ovarian tumors, it is also necessary to determine that normal uterine morphology is still

visible. In this study, 96.6% of the samples were obtained with normal uterine morphology (Figure 7B).

The low specificity value in this study was contributed by the magnitude of false positive values in the findings of this study, ie. 5 samples (mucinous cyst adenoma, endometriosis cyst). In this study, the CT appeared to have difficulty in distinguishing malignancy from a benign mass in the advanced phase of the mucinous cyst adenoma ovary, with the character of a mass with usual size of more than 10 cm, attached to the abdominal wall,

multiloculated, septated with septa thickness of 2-3 mm, containing fluid with water to blood density, which is generally found in those of 3rd and 4th decades.¹³⁻¹⁵ This was not fully obtained in this sample (Figure 7C). Since the sample was 27 years old, large mass character, thick septa, with solid components, abnormalities obtained in the imaging did not lead to benign

abnormalities. Likewise, as endometriosis cysts should show a lesion with a cystic and solid component, unilateral or bilateral with a regular outer wall, sometimes with papillary projection, showing contrast enhancement with ascites and peritoneal implants so, it was very likely that it was hardly distinguished from malignancy (Figure 7D).

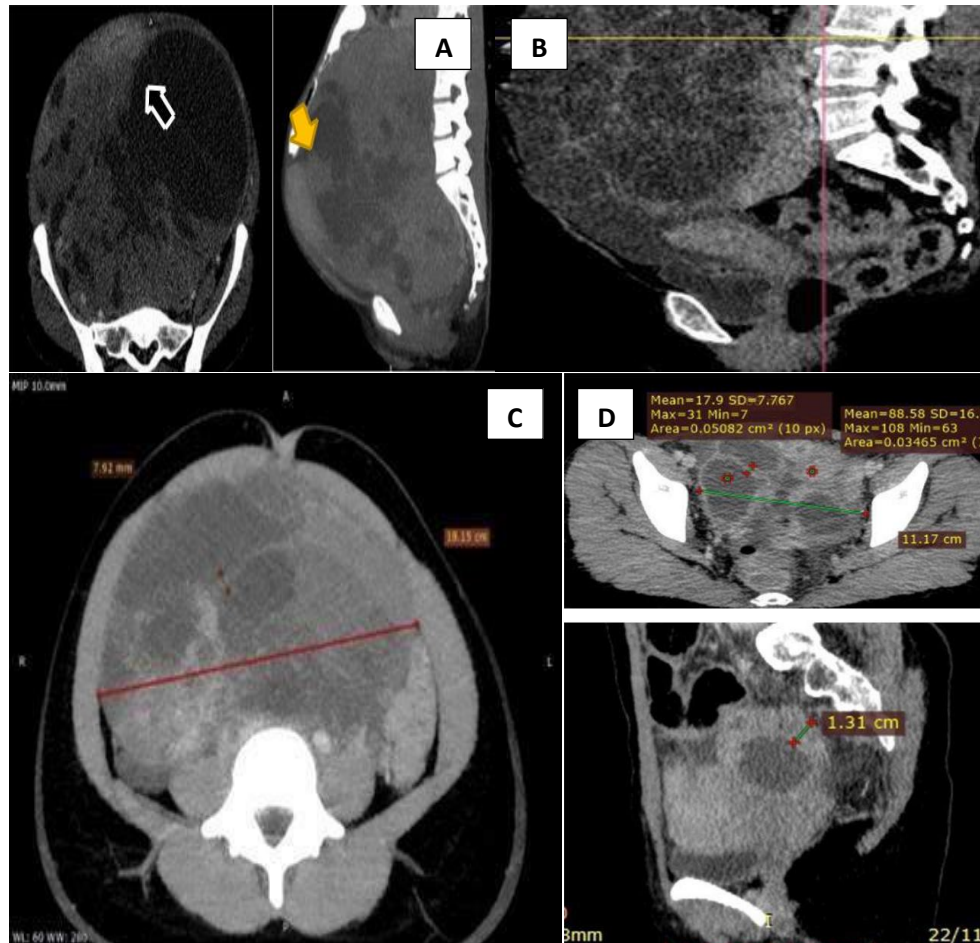


Figure 7A. A 33-year-old woman on axial and sagittal contrast-enhanced abdominal CT scan, showing a large pelvic mass that resembles ovarian malignancy. If observed on sagittal images, the uterine is pushed to the anteriosuperior (yellow arrow), with a "claw sign" (white arrow). On histopathological examination, it is suggestive of leiomyosarcoma with differential diagnosis of fibrosarcoma. Figure 7B. Sagittal contrast-enhanced abdominal CT scan, a 55-year-old woman with a pelvic mass that extends into the abdomen. The uterine morphology is still visible and has a well-defined border with a superior mass, showing that the pelvic mass does not originate from the uterine. On histopathology examination, high grade endometrioid carcinoma ovary were obtained. Figure 7C. Axial contrast-enhanced abdominal CT scan of 20 year old woman, showing a multiloculated mass, size exceeding 10 cm, with septa that is more than 3 mm in thickness, with cystic and solid components, leading to the malignancy of ovarian tumors. In fact, on histopathology examination, a mucinous cyst adenoma was shown, which directed to a benign mass. Figure 7D. Contrast-enhanced abdominal CT scan in 27 year old women, obtained a large mass, with cystic and solid components, multiloculated septated with thickness more than 3 mm which urged the uterus, in contrast administration showed contrast enhancement. This finding led to a malignancy. However, the histopathological examination was concluded as an endometriosis cyst.

CONCLUSION

Diagnostic value of contrast-enhanced abdominal CT scan in ovarian tumors in Dr. Soetomo General Academic Hospital, Surabaya, Indonesia, from January 2017 to December 2018 for 88 samples that were included in the study criteria using primary findings and additional features modified in “tools” for imaging abdominal CT scans had a sensitivity of 93.3%, specificity of 64.3%, positive predictive value of 93.3%, negative predictive value of 69.2%, and an accuracy value of 89.8%, and shows an increase compared to without tools. The low specificity value can be caused by the findings of the sample are large in size and advanced phase of the disease, so that imaging is difficult to distinguish from malignancy in ovarian tumors.

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