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Prediction of Surgical Outcomes by Image Defined Risk Factors in Children with Wilms' Tumor

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Abstract

Introduction: Wilms' tumor (WT) is one of the most common childhood abdominal malignancies. Imaging plays a central role in diagnosis, staging, and response evaluation and follows up of children with WT. The aim of this study is to evaluate Computed Tomography (CT)-based image defined risk factors according to Socie'te' Internationale d' Oncologie Pe'diatrique (SIOP) protocol in predicting surgical outcomes in children with WT.

Methods: In this prospective observational study, 31 children with Wilms' tumor attended in department of pediatric surgery, Dhaka Medical College from July 2020 to Jun 2022. Tumor size > 7cm, volume >550cm^3, ratio of tumor and abdominal diameter > 0.5, presence of displacement of great vessels, vascular thrombus, contralateral extension of tumor found on contrast enhance computed tomography (CECT) considered as Image Defined Risk Factors positive (IDRFs +). After meeting the inclusion criteria, IDRFs (+) 20 children with unilateral localized WT (stage I, II and III) treated with SIOP protocol were included in this study. Children with Image Defined Risk Factors negative IDRFs (-), stage IV, Bi-lateral, Extra-renal & syndromic WT were excluded. After neoadjuvant chemotherapy (NACT) they were reassessed for IDRFs and classified as IDRFS (+) & IDRFS (-) group. Data on preoperative CECT were collected and relations with surgical risk factors were analyzed.

Result: Out of 20 patients 9 were male and 11 were female with mean age 46.35 months, 8 (40%) were right sided and 12 (60%) were left sided. Surgical outcomes were assessed and found complete resection was possible 100% in both groups. Tumor spillage occurred 9.1% and 11.1%, operative time (mean) was 125.8 min and 77.5 min, blood loss (mean) occurred 8.85 ml/kg and 4.15 ml/kg, tumor weight (mean) was 833 (gm) and 275 (gm) in IDRF (+) and IDRF (-) group respectively and statistically found significant p-value <0.05. In this study subjects with poor surgical outcomes, 66.7% cases had positive contra-lateral extension whereas none of the study subjects with good surgical outcomes had positive contra-lateral extension.

Conclusion: Image Defined Risk Factors according to SIOP protocol are good predictors for surgical outcomes in children with unilateral localized (stage I, II, III) Wilms' tumor.

Keywords: Nephroblastoma; Image Defined Risk Factors; Surgical Outcomes.

Introduction

Wilms' tumor is the 2nd most common malignant abdominal tumor. Most

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Nilave N, et al., J Cancer Sci Clin Ther 2024
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of the patient are asymptomatic; they usually diagnosed incidentally as a painless lump by parents or by physician in routine checkup [1]. Imaging plays a central role in diagnosis, staging, response evaluation and follows up. Modern imaging techniques are valuable for diagnosis of Wilms' tumor before confirmation by histology. Recent advances in imaging techniques have shown that it is possible to diagnose this disease in its early stage. CT has been found to have accuracy of 82% and capable of an explicit report in 89% of all cases. Image Defined Risk Factors (IDRF) are surgical risk factors that identified by imaging, based on radiological criteria allowing consistent and uniform reporting. IDRF are not a contraindication for surgery rather prognostic factor and warning for surgeon. Image defined risk factors (IDRFs) are widely used in management of neuroblastoma by International Neuroblastoma Risk Group (INRG). IDRFs provide the best reproducible description of tumor anatomy, IDRFs are valuable not only for initial staging and treatment decisions, but also for anticipating surgical difficulties and completeness of resection, after neoadjuvant chemotherapy [2]. However, in Wilms' tumor image defined risk factors can be applied. Image-based surgical risk factors that can predict surgical difficulty, has not been established. CECT is used as a diagnostic tool for IDRFs in Wilms' Tumor. It provides good delineation of tumor anatomy and give information regarding - tumor size, tumor volume, ratio of abdomen and tumor diameter, involvement of great vessels and contralateral extension. By gathering this information, risk factors for surgical resection can be identified. This study was done to identify whether image defined risk factors can give information about surgical outcomes or not. Successful treatment depends upon multidisciplinary approaches – operative therapy, chemotherapy and radiotherapy. Surgery may be performed as primary therapy according to (Children's Oncology Group) COG protocol or delayed fashion (after neoadjuvant therapy) according to (Socie'te' Internationale d' Oncologie Pe'diatrique) SIOP protocol. But the fundamentals that requires for surgery are- safe resection of the tumor, accurate staging of the tumor, avoidance of complication that will upstage the tumor, avoidance of tumor spillage. Factors that influence tumor spillage, incomplete resection are- tumor size [3], ratio of abdomen and tumor diameter [4] and vascular involvement and tumor volume [5]. In this study patient with Wilms' tumor treated under SIOP protocol were evaluated by contrast enhanced (intravenous and oral) computed tomography (CECT) of abdomen to identify IDRFs and their surgical risk factors were analyzed during operative therapy. This research is able to provide some new ideas like- surgeons can anticipate poor surgical outcomes like spillage, excessive bleeding by measuring certain parameters in CT scan of abdomen. CT based image defined risk factors can guide surgeons for complete resection, avoidance of spillage. Thus it helps in preventing recurrences and relapse.

Materials & Methods

In this prospective observational study, 31 children with Wilms' tumor attended in pediatric surgery department, Dhaka Medical College from July 2020 to Jun 2022. All the patient was evaluated by proper history taking, clinical examinations and relevant investigations-Complete Blood Count (CBC), Routine and Microscopic Examination for urine (urine R/M/E), X-ray chest, Serum creatinine, 24 hour urinary Vinyllylmandelic Acid (VMA), Ultra sonogram of whole abdomen (USG of W/A), Contrast Enhanced CT (CECT) scan of abdomen and chest. Identifying risk factors from imaging, all patients was evaluated and classified either- image defined risk factors positive- IDRFs positive *(+)* or image defined risk factor negative-*IDRFs negative (-).* Tumor size > 7cm, volume >550cm^3, ratio of tumor and abdominal diameter > 0.5, presence of displacement of great vessels, vascular thrombus, contralateral extension of tumor found on contrast enhance computed tomography (CECT) considered as Image Defined Risk Factors positive (IDRFs +). After meeting the inclusion criteria, IDRFs (+) 20 children with unilateral localized WT (stage I, II and III) treated with SIOP protocol were purposively included in this study. Children with Image Defined Risk Factors negative IDRFs (-), stage IV, Bi-lateral, Extra-renal & syndromic WT were excluded. They underwent neoadjuvant chemotherapy (NACT) according to SIOP protocol consists of a 4 week regimen of vincristine (1.5 mg/m^2, maximum 2 mg) and actinomycin D (45 µg/kg IV, maximum 2 mg). After NACT they were reassessed for IDRFs and classified as IDRFS (+) & IDRFS (-) group by CECT. They underwent radial nephrectomy. Per operative surgical factors – operative time, per operative bleeding, intraoperative tumor rupture, resectability and tumor weight were measured. Surgery where tumor was completely resectable, without any spillage, with minimum blood loss, shorter duration of operation was considered as good surgical outcome. Surgery in which resection was incomplete, spillage, excessive bleeding and prolonged duration of operation occurred were considered as poor surgical outcome. Data on preoperative CECT were collected and relations with surgical risk factors were analysed.

Image Defined Risk Factors analysis

Tumor size (t) in cm, Tumor volume (v) in cm^3, Ratio of Tumor & abdominal diameter (t/T), Contra-lateral extension of tumor, Displacement of great vessels, Presence of intravascular tumor thrombus were identified on oral and intravenous contrast CECT of abdomen. Tumor diameter (t) of the tumor was noted by measuring the maximum transverse diameter of tumor found on axial plane of CECT. Figure No: 1 [3] Tumor volume was measured by multiplication of tumor diameter (t), depth (ap) on axial plane and height (h) found on coronal plane of CECT. Figure No: 1 [5] the ratio was the maximum diameter of tumor and diameter

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Nilave N, et al., J Cancer Sci Clin Ther 2024
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of abdomen at same plane found on axial plane on CECT [4]. (Figure No:1) Tumor extending beyond the midline of vertebral body found on CECT was considered contralateral extension. (Figure No: 2) Tumor compressing abdominal aorta or inferior vena cava were considered as displacement of great vessels. Figure No: 2 Intravascular tumor thrombus was also saught in early contrast CECT. Tumor size > 7cm, volume >550cm³, ratio of tumor and abdominal diameter > 0.5, presence of displacement of great vessels, vascular thrombus, contralateral extension of tumor found on contrast enhance computed tomography (CECT) considered as Image Defined Risk Factors positive (IDRFs +).

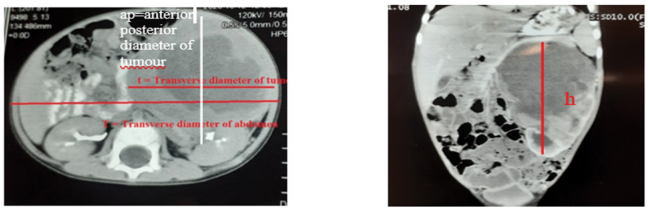

Figure 1: Measurements on CECT images: the three-dimensional size of the tumor, transvers diameter of tumor (t). Anterior posterior diameter of tumor (ap). Tumor height (h) were measured on CT slice. Tumor volume calculated by (t×ap×h). Ratio of transvers diameter of tumour (t) and transvers diameter of abdomen (T) (t/T) calculated.

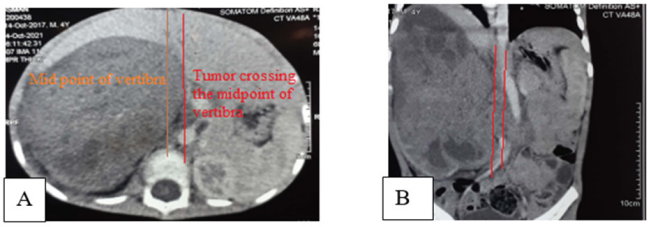

Figure 2: Contralateral extension of the tumors and displacement of great vessels (A) Contralateral tumor extension was defined as tumor extending beyond the midline of the vertebral body. (B) Displacement of the great vessels was defined when a left-sided tumor compressed the abdominal aorta or a right-sided tumor compressed the abdominal aorta or a right-sided tumor compressed the inferior venacava.a

Analysis of Surgical Outcome

Surgery where tumor was completely resectable, without any spillage, with minimum blood loss, shorter duration of operation was considered as good surgical outcome. Whereas Surgery in which resection was incomplete, spillage, excessive bleeding and prolonged duration of operation occurred were considered as poor surgical outcome. Spill refers to a break in the tumor capsule during operative removal, whether – accidental, unavoidable or by design. Per operative blood loss was measured from subjective assessment from surgeon and anesthesiologist and suction apparatus and blood loss ≥10ml/kg body weight was considered poor surgical outcome. Duration from starting incision to the end of skin closure was measured. Duration of surgery more than 2 hours was considered poor surgical outcome. Tumor weight was measured after resection of specimen and weight ≥ 550 gm was considered as poor surgical outcome.

Statistical Analysis

The analysis of different variable was done according to standard statistical analysis. Qualitative data were expressed as frequency with percentage and quantitative data were expressed as mean with standard deviation. Quantitative data were analyzed by student t-test & Mann Whitney U test and qualitative data by Fisher's exact test. Correlation was done use Pearson correlation coefficient test. For all analysis level of significance was set at 0.05 and p-value <0.05 was considered as significant. Statistical Package for Social Science (SPSS) 23 was used for data analysis.

Ethical Consideration

Ethical clearance was sought from the Ethical Review Committee of Dhaka Medical College and informed written consent from parents or legal guardian was taken after describing the study objectives.

Results

Out of 31 patients of WT IDRFs (+) 20 patients were selected as study population those who met the inclusion criteria. They underwent neoadjuvant chemotherapy, preoparetive IDRFs were assesed and found 11 were still CT based IDRFs (+) and 9 became IDRFs (-). They underwent surgery and surgical outcome was observed. Among them 9, 10 and 1 were stage I,II and III disease. Most of the study subjects (75.0%) were ≤60 months old. Mean age was 46.35 months. Females (55.0%) were slightly predominant and maximum tumors were in left side (60.0%) (Table 1).

Contralateral extension and displacement of great vessels present in 8 (46%) and (44%) cases after neoadjuvant chemotherapy. Vascular thrombus found in 1 (5%) both at diagnosis and after neoadjuvant chemotherapy. Mean transverse diameter decrease to 8.33 cm which was initially 11.15 cm. Mean volume was 596.73 which was initialy 1060.29 cm³ (Table 2).

All the patients got 4 weeks regimen of NACT according to SIOP protocol and 11 (55.0%) cases were still IDRFs (+) and 9 (45%) became IRDFs (-) (Table 3). They underwent radical nephrectomy, during nephrectomy surgical risk factors were sought. Complete resection was possible in all cases, spillage occurred in 2 cases – 1 in IDRF (+) ve and 1 in IDRFs (-) ve group, operative time, tumor weight and the amount of intraoperative bleeding were compared in IDRFs (+) and IDRFs (-) group. Intraoperative blood loss was significantly higher among IDRFs (+) group (8.85 ± 4.15 ml/kg) than IDRFs (-) group (4.14 ± 0.52 ml/kg). Similarly, operative time was significantly higher among the study

Nilave N, et al., J Cancer Sci Clin Ther 2024
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Table 1: Demographic profile of the study subjects (N=20)

	Frequency (n = 20)	Percentage (%)
Age		
6 month -1 Year	2	10
> 1-3 Year	10	50
> 3-5 Year	3	15
> 5-7 Year	2	10
> 7-9 Year	2	10
> 9-11 Year	0	0
> 11-14 Year	1	5
Mean	46.35	
Weight (kg) (Mean)	12.65	
Gender		
Male	9	45
Female	11	55
Laterality		
Right	8	40
Left	12	60

Table 2: Measurement of Parameters on CECT images of IDRFs (+) patients at diagnosis, after neoadjuvant chemotherapy. (N=20)

Parameters of IDRFs	At diagnosis n (%)	After neoadjuvant chemotherapy n (%)
Contra-lateral extension of tumor	15 (75.0)	8 (40.0)
Displacement of great vessels	18 (90.0)	8 (40.0)
Venous thrombus	1 (5%)	1 (5%)
Transverse diameter of tumor (t) in cm	11.15 ± 3.16	8.33 ± 3.75
T. diameter of abdomen (T) in cm	17.00 ± 3.32	16.93 ± 3.36
Ratio of Tumor & abdominal diameter (t/T)	0.66 ± 0.15	0.49 ± 0.16
Tumor depth	9.40 ± 1.61	7.29 ± 2.41
Tumor height	9.42 ± 2.56	7.21 ± 3.24
Tumor volume (v)	1060.29 ± 600.05	596.73 ± 635.48

subject with IDRFs (+) ve (125.83 ± 58.69 min) than IDRFs (-) ve (77.50 ± 7.07 min). Tumor weight was also found significantly higher among the IDRFs (+) ve group (833. 33 ± 503.77 gm.) than IDRFs (-) ve group (275.00 ± 128.17 gm.) (Table 4).

Contralateral extension was observed for surgical outcome and found patients with poor surgical outcome, 8 (66.7%) cases had positive contra-lateral extension whereas none of the study subjects with good surgical outcome had positive contra-lateral extension. The difference was statistically significant ($p<0.05$) (Fisher's Exact test was done). (Fig 3) Intraoperative blood loss was significantly higher among the study subject positive contra-lateral extension (9.54 ± 4.11 ml/kg) than negative contra-lateral extension (5.25 ± 2.88 ml/kg). Similarly, operative time was significantly higher among the study subject with positive contra-lateral extension (142.50 ± 61.59 min) than negative contra-lateral extension (82.50 ± 22.61 min). Tumor weight was also found significantly higher among the study subject with positive contra-lateral extension (1018.75 ± 511.26 gm.) than negative contra-lateral extension (337.50 ± 177.26 gm.) (Table 5).

And same to happen in patient with displacement of great vessels. Patient with poor surgical outcome, 8 (66.7%) cases had displacement of great vessels whereas none of the study subjects with good surgical outcome had displacement of great vessels. The difference was statistically significant ($p<0.05$). (Fisher's exact test was done) (Figure 4) Intraoperative blood loss was significantly higher among the study subject with displaced great vessels (10.30 ± 3.57 ml/kg) than non-displaced great vessels (4.74 ± 2.34 ml/kg). Similarly, tumor weight was also found significantly higher among the study subject with displaced great vessels (1006.25 ± 521.29 gm) than non-displaced great vessels (345.83 ± 192.42 gm). Though operative time was higher among the study subject with displaced great vessels (130.00 ± 63.02 min) than non-displaced great vessels (90.83 ± 36.05 min), difference was not statistically significant (Table 6).

In this study, operative time, blood loss and spillage were tried to make a relationship with various image parametrs separately. Operative time had significant positive correlation with diameter of tumor and also with ratio of transverse tumor and abdomen (t/T). (Table 7) Blood loss had significant positive correlation with depth, diameter, height and volume of tumor. Blood loss also had a significant positive correlation with transverse diameter of tumor, tumor volume, ratio of transverse tumor and abdomen (t/T) (Table 8). No association of spillage was found with depth, diameter, height and volume of tumor and also with tumor-abdomen width ratio (t/T) (Table 9).

Table 3: IDRFs Status of the study subjects after neoadjuvant chemotherapy (N=20)

	Frequency (n)	Percentage (%)
CT based IDRFs (+)	11	55
CT based IDRFs (-)	9	45

Table 4: Operative time, tumor weight and the amount of intraoperative bleeding in the IDRFs (+) and IDRFs(-) (N=20)

Parameters	CT based IDRFs(+) Group	CT based IDRFs(-) Group	p-value
Blood loss (ml/kg)	8.85 ± 4.15	4.14 ± 0.52	0.005
Operating time (min)	125.83 ± 58.69	77.50 ± 7.07	0.034
Tumor weight (gm)	833.33 ± 503.77	275.00 ± 128.17	0.007

Unpaired t test was done

Nilave N, et al., J Cancer Sci Clin Ther 2024
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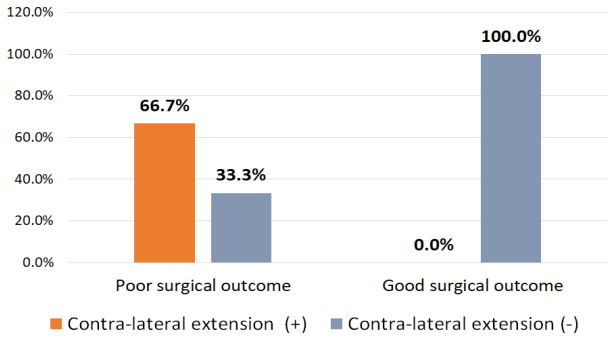

Figure 3: Bar diagram showing association between contralateral extension and surgical risk (N=20)

Table 5: Operative time, bleeding and tumor weight in relation to contralateral extension (N=20)

	Contra-lateral extension		p-value
	(+) (n=8)	(-) (n=12)	
Blood loss (ml/kg)	9.54 ± 4.11	5.25 ± 2.88	0.013
Operating time (min)	142.50 ± 61.59	82.50 ± 22.61	0.006
Tumor weight (gm)	1018.75 ± 511.26	337.50 ± 177.26	<0.001

Unpaired t test was done

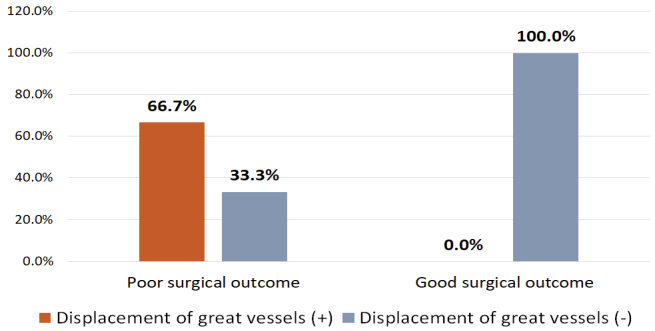

Figure 4: Bar diagram showing association between displacement of great vessels and surgical risk (N=20)

Table 6: Operative time, tumor weight and bleeding in relation to the displacement of great vessels (N=20)

	Displacement of great vessels		p-value
	(+) (n=8)	(-) (n=12)	
Blood loss (ml/kg)	10.30 ± 3.57	4.74 ± 2.34	0.001
Operating time (min)	130.00 ± 63.02	90.83 ± 36.05	0.093
Tumor weight (gm)	1006.25 ± 521.29	345.83 ± 192.42	0.001

Unpaired t test was done

Table 7: Correlation of operative time with various image parameters (N=20)

	r	p-value
Depth (ap)	0.406	0.076
Diameter (t)	0.475	0.034
Height (h)	0.442	0.051
Volume (v)	0.373	0.105
ratio of transverse tumor and abdomen (t/T)	0.53	0.016

Pearson correlation test was done

Table 8: Correlation of blood loss with various image parameters (N=20)

	r	p-value
Depth (ap)	0.688	<0.001
Diameter (t)	0.71	<0.001
Height (h)	0.7	<0.001
Volume (v)	0.751	<0.001
ratio of transverse tumor and abdomen (t/T)	0.631	0.003

Pearson correlation test was done

Table 9: Association of spillage with various image parameters (N=20)

	Spillage	Non-spillage	p-value
Depth (ap)	5.75 ± 3.89	7.46 ± 2.30	0.658
Diameter (t)	5.65 ± 3.04	8.63 ± 3.78	0.207
Height (h)	5.65 ± 4.03	7.38 ± 3.23	0.612
Volume (v)	296.48 ± 377.70	630.09 ± 656.63	0.449
ratio of transverse tumor and abdomen (t/T)	0.35 ± 0.26	0.50 ± 0.15	0.45

Mann-Whitney U test was done

Discussion

Combined therapy approaches such as integrated chemotherapy, surgery and radiotherapy have significantly improved outcomes of patient with Wilms' tumor. The treatment of Wilms' tumor can be considered as a model for the multimodal treatment of malignant solid tumors in childhood whereas surgery is the corner stone for the management of Wilm' tumor. Timing of surgery depends upon the protocols (SIOP and COG) but surgical principle is to ensure- safe resection of the tumor; accurate staging of the tumor; avoidance of complications that 'upstage' the tumor (rupture or unnecessary biopsy), and accurate documentation of the operative findings. Tumor spill and irresctability are important factors for good surgical outcomes. Recurrence and relapse occurred where per operative spillage occurred, had positive resection margin and local invasion to adjacent structures [6]. According to SIOP the concept of giving neoadjuvant chemotherapy to all patients to shrink the tumor with a view to reducing the risk of tumor rupture during upfront surgery, as was seen during NWTS studies. Neoadjuvant abdominal irradiation decreased nephrectomy complications like tumor rupture from 33% (20 of 60 nephrectomies) to 4% (3 of 72 nephrectomies) and reduces the need for postoperative abdominal radiotherapy for tumor rupture cases during nephrectomy [7]. There are few studies that predict the adverse surgical outcomes like tumor rupture, excessive bleeding, and incomplete resection, prolonged operative time based on tumor morphology like tumor size, volume, and presence of vascular thrombus, contralateral extension, and displacement of great vessels. Some studies

Nilave N, et al., J Cancer Sci Clin Ther 2024
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found relationship with single variables like ratio of tumor and abdominal area were correlated with intraoperative tumor rupture by Fukuzaea et al, relationship with tumor size and tumor rupture by Ritchley et al and Gow et al, Tumor rupture was correlated with tumor volume by Bekar et al and Provenzi et al. A retrospective study was performed by Oue et al in Japan with twentynine patients with WT considering multiple image parameters in a same setting like - tumor size, volume, presence of vascular thrombus, contralateral extension, and displacement of great vessels and operative findings were collected and analysied with image parameters and found image based risk factors significantly associated with surgical risk factors [9].

In this prospective observational study surgical risk factors were predicted by Image parameters. Tumor size, tumor volume, abdomen tumor ratio, contralateral extension, displacement of great vessels and intravascular thrombus were used as predictive tool for surgical risks.

In this study, mean age was 46.35 months ranging from 8 to 144 months. Brillantino C, et al revealed mean age at diagnosis was 44 months which also similar with this study. Regarding laterality right sided was 40% and left sided was 60% which was similar with Oue et al [9] Male and females were almost equally distributed (Table 1). In this study spillage was revealed in 2(10.0%) cases. Complete resection was possible in all cases. G. Hall et al [10] revealed tumor spillage was 5.3%. Tumor spillage was 9.09% in IDRF (+) group and 11.1% in IDRF (-) group. Tumor spillage occurred at tumor volume 29.4 cc cc and at maximum tumor diameter 3.5 cm. Spillage occurred as tumor capsule was adherent with right lobe of liver. Bekar et al [5] reported that tumor size more than 1000 cc had increased risk of tumor spill. Gow et al. [3] reported that a larger tumor diameter >12 cm is a risk factor for intraoperative tumor spillage. This dissimilarity was due surgical difficulty during tumor resection. In another case tumor spillage occurred in IDRFs (+) group where the tumor volume was 564 cc and ratio of tumor and abdomen was 0.54. In this case tumor consists of totally necrotic tissue with a very thin rim of capsule. Fukuzawa et al. [4] reported higher chance of spillage where tumor abdominal ratio > 0.5. Intraoperative blood loss was found significantly higher among IDRF (+) patients (8.85 ± 4.15 ml/kg) than IDRF (-) patients (4.14 ± 0.52 ml/kg) (p=0.005). Similarly, Oue et al. (2017) revealed larger amount of blood loss in high risk surgery group than low risk surgery group but the difference was not statistically significant in their study. Intraoperative blood loss was significantly higher among the study subject with contra-lateral extension (9.54 ± 4.11 ml/kg) than within the midline (5.25 ± 2.88 ml/kg) which was similar with Oue et al [9]. Intraoperative blood loss was significantly higher among the study subject with displacement great vessels (10.30 ± 3.57 ml/kg) than without displacement great vessels (4.74 ± 2.34 ml/kg). Similar finding was observed in the study of Oue et al. [9] where mean bleeding was significantly more in cases with displacement of great vessels than in cases without displacement (p = 0.033). In this study, Blood loss had significant positive correlation with depth, diameter, height, volume of tumor, tumor and abdomen width ratio (t/T). Similarly, Oue et al. [9] discovered that image parameters correlated significantly with intraoperative bleeding. The correlation coefficient with tumor volume was highest with this study's evaluation of the correlations with intraoperative bleeding. In this study Mean operating time was 106.50 ± 51.02 minutes ranging from 60 to 210 minutes. (Table 4.4) Umar et al (2018) revealed mean operative time 216±78.7 minutes. Operative time was significantly longer in IDRF (+) patients (125.83 ± 58.69 min) than IDRF (-) patients (77.50 ± 7.07 min) (p=0.034). Mean operative time was significantly longer in the high risk surgery group than the low risk surgery group (p = 0.018) [9]. In this study, operative time was significantly longer among the study subject with contra-lateral extension (142.50 ± 61.59 min) than negative contra-lateral extension (82.50 ± 22.61min). Oue et al (2017) reported mean operative time was significantly longer in cases with contralateral extension than in cases where contra-lateral extension absent (p = 0.019). Though operative time was higher among the study subject with displaced great vessels (130.00 ± 63.02 min) than non-displaced great vessels (90.83 ± 36.05 min), difference was not statistically significant which was comparable with Oue et al.

In this study, operative time was found to have a significant positive correlation with tumor diameter, as well as tumor-abdomen width ratio (t/T). In the study of Oue et al. (2017), image parameters correlated significantly with operative time. When the correlation between tumor dimensions and operative time was examined, it was discovered that the correlation coefficient was highest with tumor area. The absolute tumor size may be related to operational risks. In this study, among the study subjects with poor surgical outcome, 66.7% cases had contra-lateral extension whereas none of the study subjects with good surgical outcome had contra-lateral extension. The difference was statistically significant (p=0.005). The rate of contralateral extension was significantly higher in the high risk surgical group than the low risk surgical group (p = 0.041) in the study of Oue et al., (2017). Unilateral WT with good histology, a tumor area to abdominal area ratio greater than 0.5 may be a predictor of intraoperative tumor rupture [4]. Body size varies widely among pediatric patients. They therefore believed that tumor size should be viewed in relation to body size. The rise in intra-tumor pressure caused by the weight of the tumor may lead to the rupture of the tumor capsule. Additionally, the region of the tumor that needs to be removed may be related to the length of the procedure and the amount of bleeding. So, rather than adjusted tumor size, absolute tumor size may be a better indicator of tumor spillage. In this study 1 (5%)

Nilave N, et al., J Cancer Sci Clin Ther 2024
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case found venous thrombus (at renal vein) at diagnosis and persists after neoadjuvant chemotherapy. This patient has significant blood loss 10ml/kg and operation time was 150 min. According to the findings of this study, contralateral extension is also significantly associated with surgical risks, operative time, and bleeding. These findings imply that the surgical difficulty is likely to be greater in patients with tumors that extend beyond the midline. If the tumor extends beyond the midline, access to the renal hilum will be difficult, potentially increasing surgical risks. As a result, it is thought that contralateral extension should also be considered as an image-based surgical risk factor. Displacement of great vessels was significantly higher among the study subject with poor surgical outcome than good surgical outcome (66.7% vs 0.0%; p=0.005), this result was comparable with the study of Oue et al. (2017) where they found displacement in 50.0% cases of good surgical outcome but 100% cases in poor surgical outcome.

Conclusion

In conclusion, Computed Tomography (CT) based Image Defined Risk Factors such as Tumor size < 7cm, tumor volume < 550 cc, ratio of tumor and abdomen < 0.5, contralateral extension, displacement of great vessels and intra vascular thrombus identified by CECT of abdomen are good predictors for complete resection, operative time, less blood loss, tumor weight.

Limitation

Some CT scan quality was poor due to movement of patient during CT scan. Small sample size was also a limitation of this study

Recommendations

IDRFs are good predictor for surgical outcomes in children with unilateral localized Wilms' tumor. It is recommended that further studied should be done with larger sample in multi center with long term follow up.

Conflict of interest

No conflict of Interest from any member of author.

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