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ORIGINAL RESEARCH

Clinical Characteristics and Prognosis Analysis of Infantile Hepatoblastoma—A 15-Year Retrospective Single-Center Study

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Objective: The present study aimed to summarize the clinical data of hepatoblastoma (HB) in infants under one year of age and to analyze the factors that affected the prognoses.

Methods: The clinical data of 132 pediatric patients with a pathologically confirmed HB, aged less than one year and who had visited the Pediatric Single Center of Beijing Tongren Hospital from May 2005 to May 2019, were retrospectively analyzed to summarize the clinical outcomes and prognoses.

Results: The male/female ratio was 1.27 and the median age was 8.40 months. The onset of HB was usually characterized by abdominal bulging (75.0%). The median level of AFP at the first visit was 154.7μg/mL, and the average platelet count was $(405\pm166)\times10^9$/L. The epithelial type (57.6%) was the predominant pathological type, and stage III (54.5%) was the main PRETEXT staging. Distant metastases occurred in 45 cases, with pulmonary metastases (86.7%) being the most common site. At the time of visit, 24 cases (18.2%) had either portal vein, hepatic vein, or vena cava infiltration. Five cases (3.8%) had a hemorrhage of the ruptured tumor, and 26 cases (19.7%) had multiple intrahepatic foci. At the follow-up in May 2020, the overall survival (OS) rate at one, three, and five years of age was 94.3%, 88.8%, and 80.1%, respectively, and the event-free survival rate was 91.8%, 86.9%, and 77.5%, respectively, by the Kaplan–Meier survival analysis. According to the Log rank test, pediatric patients with an AFP <100ng/mL, a PRETEXT stage IV, presence of distant metastases and multiple foci of the primary tumor at the initial diagnosis had poorer prognoses ($P<0.05$).

Conclusion: The prognosis of HB in infancy is relatively good, but is still vulnerable to multiple factors, such as tumor features leading to different AFP levels, PRETEXT stage, presence of distant metastases, and multiple intrahepatic foci.

Keywords: hepatoblastoma, infant, AFP, chemotherapy, prognosis

Hepatoblastoma (HB) is an embryonic malignancy with various differentiation patterns and is the most common hepatic malignancy in infants and children.[1,2] In recent years, the occurrence of HB is becoming more common in younger children, and the number of cases of HB being diagnosed in infancy is increasing. In some cases, the hepatic occupancy is detected by fetal ultrasonography during pregnancy, and HB is diagnosed by pathology after birth.[3,4] For infantile HB, early detection and intervention are particularly important to prolong survival. In the present study, the clinical data of 132 cases, with pathologically confirmed HBs in infants under one year old and who attended our Pediatrics Single Center from May 2005 to

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May 2019, were retrospectively analyzed. The therapeutic efficacy and prognostic factors for the combined multidisciplinary treatment were investigated and analyzed to provide a clinical reference for the diagnosis and treatment of HB in infants in China.

Materials and Methods

Study Subjects

The clinical data of 132 pediatric patients under one year of age, with HBs diagnosed by pathology and/or imaging and serology of primary hepatic tumors, who were admitted to the Pediatrics Single Center of Beijing Tongren Hospital affiliated to the Capital Medical University from May 2005 to May 2019, were collected and statistically analyzed. All of the relevant examinations and treatments were performed with signed and informed consents from the guardians. The study was approved by the Ethics Committee of Beijing Tongren Hospital, Capital Medical University.

Criteria for Pathological Histotype and Staging

According to the new international consensus of the histopathological staging of pediatric hepatic tumors,[5] the pathological histotypes were divided into the epithelial type and mixed type. The epithelial types were subdivided into the fetal type, the embryonic type, the mixed fetal and embryonic type, and the small cell undifferentiated type. The mixed types were subdivided into the mixed epithelial-mesenchymal lobes containing teratogenic tissue and without teratogenic tissue. The PRETEXT staging system[6] proposed by the International Childhood Liver Tumor Strategy Group (SIOPEL) was adopted, and HBs were divided into four stages based on the anatomy of the liver and the number of liver segments that were affected by the mass. Stage I included cases where the tumor was confined to one liver segment, with no tumor invasion in three adjacent liver segments; Stage II included cases where the tumor involved two liver segments, and the other two adjacent liver segments were not invaded by the tumor; Stage III included cases where the tumor involved two liver segments, and the other two non-adjacent liver segments were not involved, or the tumor involved three liver segments; and Stage IV included cases where the tumor involved four liver segments.

Comprehensive Therapeutic Regimen

For pediatric patients with clinically suspected HB, and those with the PRETEXT stage I or stage II, surgical resection of the mass should be conducted first, followed by postoperative chemotherapy. For some pediatric patients with the PRETEXT stage II, III or IV, neoadjuvant chemotherapy might be given first, usually with 2–4 cycles of chemotherapy before surgery and 4–6 cycles of consolidation chemotherapy after surgery. The conventional first-line chemotherapy regimens were the C5V regimen (cisplatin + fluorouracil + vincristine) and the PLADO regimen (cisplatin + adriamycin). For cases with poor response to the first-line chemotherapy, repeated recurrence, or metastasis, individualized chemotherapy could be conducted, such as irinotecan + cyclophosphamide + cisplatin + vincristine, etoposide + cisplatin + pirarubicin or cyclophosphamide + cisplatin + epirubicin, as well as other regimens. The cycle of chemotherapy could be extended to 12–18 cycles, and the therapeutic effects during the chemotherapy should be evaluated according to the World Health Organization (WHO) classification criteria for side effects of drugs in chemotherapy. For pediatric patients with large tumors, tumors difficult to be surgically resected, or multiple intrahepatic metastases, the arterial interventional embolization could be adopted.[7] Interventional chemotherapy, such as cisplatin and doxorubicin, could be used during the surgery (in the present study, the arterial intervention chemoembolization was conducted in 15 cases). For some pediatric patients with tumors of the PRETEXT stage IV, invasion of the portal vein, or with tumors that are unable to be removed by conventional surgery, as well as residual or recurrence in the liver after surgery, liver transplantation could be considered. In addition, new treatment methods, such as targeted therapy and molecular biological therapy, might also be conducted.

Monitoring Indicators, Follow-Up, and Evaluation Criteria

The imaging examinations (B-ultrasound, CT) of the primary tumors and/or metastases were conducted every two chemotherapy cycles. The serum alpha-fetoprotein (AFP) assay was performed before each chemotherapy (the instrument used for the AFP assay was Roche Cobas e601 electrochemiluminescence immunoassay instrument, and the normal reference range was <20ng/mL). The human chorionic gonadotropin (hCG) was tested in some pediatric patients (the normal reference range was <2.5mIU/mL). The peripheral blood routine test, hepatic and renal function, and myocardial enzymes were

monitored during chemotherapy. The follow-up date was in May 2020 and was completed by returning to the hospital for review, as well as with a telephone follow-up. According to the results of the follow-up, the clinical data, overall survival (OS) rate, and event-free survival (EFS) rate of the pediatric patients were statistically analyzed. The prognostic factors and the safety of chemotherapy were also analyzed.

Criteria for Therapeutic Efficacy

Complete remission (CR): The tumor disappeared completely after treatment; there was no evidence of residual tumor in imaging; and serum AFP was normal for more than 4 weeks. Partial remission (PR): The tumor had shrunk by more than 50%; there was no new focus; and the serum AFP had been significantly reduced by more than 20%.[9] Progresses disease (PD): During the treatment, the tumor mass increased by more than 25% or with the appearance of newly-onset tumor focus, or the AFP increased or exceeded the normal reference range for two consecutive weeks. Relapse: After complete remission of the tumor, it was confirmed by either pathological biopsy or with definite imaging evidence that the tumor had re-occurred, and the serum AFP had increased three consecutive times within four weeks, or if death occurred.[8]

Statistic Methods

The SPSS 19.0 software was adopted for data analysis. The χ^2 test was used for comparison between groups, the Kaplan–Meier method was used for survival analysis, and the Log rank test was adopted for comparison of survival rates among subgroups. $P<0.05$ was considered statistically significant.

Table 1 Clinical Characteristics of 132 Infant HB

Characteristics		Number	Proportion (%)
Gender	Male	74	56.1
	Female	58	43.9
Age (months)	<6	50	37.9
	>6	82	62.1
AFP at initial diagnosis	<100ng/mL	15	11.4
	100ng/mL-1 000μg/mL	97	73.5
	>1 000μg/mL	20	15.1
Platelet count at initial diagnosis ($\times10^9$/L)	≤400	57	43.2
	>400	75	56.8
Pathological classification	Epithelial type	76	57.6
	Fetal	51	67.1
	Embryonal	21	27.6
	Mixed fetal and embryonal	2	2.6
	Small cell undifferentiated	2	2.6
	Mixed type	56	42.4
PRETEXT stage	I	8	6.1
	II	45	34.1
	III	72	54.5
	IV	7	5.3
Vascular invasion	Yes	24	18.2
	No	108	81.8
Tumor rupture	Yes	5	3.8
	No	127	96.2
Distant metastasis	Yes	45	34.1
	No	87	65.9
Multiple liver lesions	Yes	26	19.7
	No	106	80.3

Results

Clinical Characteristics

Clinical Symptoms

The clinical data of the 132 pediatric patients enrolled in the present study are illustrated in Table 1. There were 74 males and 58 females with a male/female ratio of 1.27. The age ranged between 0.93 months to 11.57 months with a median age of 8.40 months. The age at diagnosis in most patients was >6 months (62.1%). In the present study, three pediatric patients were detected by the fetal B-ultrasonography during pregnancy (32–36 weeks of the gestation age) with a suggestion of hyperechoic occupancy in the liver area, which meant the existence of a liver space-occupying lesion, and were pathologically diagnosed as HB after birth. Among these, two were born with low birth weights and the third with a very low birth weight. The birth weights of the three cases were 2130g, 1950g, and 1360g, respectively. The mothers of two of the pediatric patients were pregnant with advanced age, and the pregnancies were complicated with hypertension. The mother of one case had a history of smoking. In the present study, six pediatric patients were test-tube babies, and three of them were fraternal twins. At the first visit, abdominal bulging was the most common symptom found in 99 cases (75.0%), followed by anorexia, vomiting, and diarrhea in 18 cases (13.6%). Other symptoms at the onset of HB were a lack of weight gain in six cases (4.5%), yellowish skin in five cases (3.8%), and four cases (3.0%) were diagnosed on physical examination.

Laboratory Indicators, Pathological Histology, and Clinical Staging

In the present study, the platelet count at the first visit was (405±166)×10^9/L with the maximum level of 550×10^9/L and the minimum level of 102×10^9/L. The median AFP in the infantile HB at the first visit was 154.7μg/mL. In most cases (73.5%), the levels were in the range of 100ng/mL–1000μg/mL. The level of hCG was detected in 30 infants with HB at the first visit in the present study. Among them, 19 pediatric patients had elevated hCG, ranging from 7.28–1040mIU/mL. One of these cases included a 9-month-old, male patient with a blood hCG level of 988mIU/mL and evidence of precocious puberty, such as penis enlargement and scrotum pigmentation. Concerning the pathological types, 76 cases (57.6%) were the epithelial type, and 56 cases (42.4%) were the mixed type. Among the epithelial type, the fetal type was the most common (67.1%), followed by the embryo type (27.6%). In the case of the PRETEXT staging, stage III was most common (54.5%), followed by stage II (34.1%).

Metastasis

In the present study, distant metastases were found in 45 cases at the time of diagnosis. The most common metastasis site was the lungs, accounting for 39 out of the 45 cases (86.7%). Among them, 27 cases had unilateral lung metastasis (10 cases of the left lung metastasis and 17 cases of the right lung metastasis), and 12 cases had bilateral lung metastasis. In addition, 29 cases (74.4%) had pure marginal zone lung metastases, and 10 cases (25.6%) had marginal zone combined with central lung metastases. There were six cases with intracranial metastases, four cases with bone metastases, two cases with right atrial tumor thrombi, one case with intestinal and mesenteric metastasis, and one case with intraspinal metastasis. There were 24 cases (18.2%) with either the portal vein, hepatic vein, or vena cava invasion at the time of visit, and 26 cases (19.7%) had multiple intrahepatic loci. Five cases (3.8%) had hemorrhages due to tumor rupture at the onset of HB. Among them, two cases had intra-tumor hemorrhages with mild clinical symptoms, and the hepatic occupancy and hemorrhage in the hepatic tumor were only found by abdominal B-ultrasonography due to abdominal pain. In the other three cases, due to the rupture of the tumor capsule and hemorrhage, there existed severe abdominal pain, anemia, and increased heart rate. A decrease in hemoglobin and hematocrit was detected in the routine blood test, and evidence of hepatic occupancy, hemorrhagic locus, and free fluid in the abdominal cavity were discovered by abdominal B-ultrasonography or CT. After receiving the interventional therapy and medical hemostatic therapy, the symptoms improved in four of the cases. One case with a hemorrhage from the rupture of the tumor capsule eventually died of hemorrhagic shock.

Survival and Prognosis Analysis

The follow-up appointments were analyzed in May 2020. The duration of the follow-ups ranged between 2–162 months with a median follow-up duration of 58 months. Among these cases, 84 had CR and 18 had PR. The therapeutic efficacy was 77.3% (102/132). Nine cases had PD and 21 cases had died. According to the Kaplan–Meier survival analysis, the one-year, three-year, and five-year OS rates were 94.3%, 88.8%, and 80.1%, respectively, and the EFS rates were 91.8%, 86.9%, and 77.5%, respectively (Figure 1). In addition, 78 cases achieved complete resection of the primary tumor through surgical operations (32 cases could not be surgically removed due to the size of the tumor. After regular chemotherapy in our center before surgery, the tumors were significantly reduced in size compared, and the opportunity for complete resection of the primary tumor was obtained). The complete resection rate was 59.1%.

The Log rank test analysis of the factors that might affect the prognosis of HB was conducted, and the one-year, three-year and five-year EFS rates between different subgroups were compared (as shown in Table 2). It was suggested that the prognosis of infantile HB with an AFP of 100ng/mL–

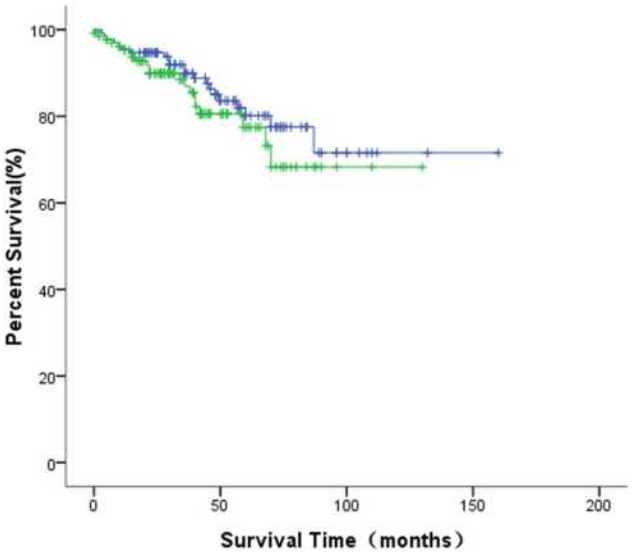

Figure 1 The Kaplan–Meier survival analysis of OS rates and the EFS rates in one-year, three-year, and five-year.

Table 2 Single Factor Comparison of 132 Cases of Infantile HB with 5-Year EFS

Factor		1 Years EFS (%)	3 Years EFS (%)	5 Years EFS (%)	χ^2	P
AFP at initial diagnosis	<100ng/mL 100ng/mL-1000μg/mL >1 000μg/mL	78.8 92.0 90.4	65.3 89.7 77.5	49.2 85.6 58.3	4.286	0.039
PRETEXT stage	I II III IV	100 98.6 80.7 51.3	100 98.0 78.5 43.6	100 97.8 69.4 28.6	18.682	0.000
Distant metastasis	Yes No	89.5 94.3	81.2 91.5	63.5 89.2	15.032	0.007
Multiple liver lesions	Yes No	72.8 93.5	55.6 89.4	31.5 85.7	32.087	0.000

1000μg/mL at the first visit was better, and the five-year EFS rate could reach 85.6%. The prognosis of HB children with AFP < 100ng/mL is relatively poor. The PRETEXT staging system was also a statistically significant risk factor. All pediatric patients with PRETEXT stage I survived, while the five-year EFS rates of patients with stage IV was significantly reduced to only 28.6%. Also, patients with distant metastases and multiple primary tumors had relatively poor prognoses. In the present study, the survival rate was not significantly correlated with factors such as gender, age of onset, platelet count, pathological type, vascular invasion, and rupture of the tumor (P>0.05, with no statistic differences).

Evaluation of the Therapeutic Safety

Due to the imperfect development of various organs in infants, we needed to pay more attention to the possible toxicity in infants with HB during systemic chemotherapy. According to the WHO classification standard for toxic and side effects of chemotherapy, there were 15 cases with grade 0 (11.4%), 28 cases with grade I (21.2%), 48 cases with grade II (36.3%), 31 cases with grade III (23.5%) and 10 cases with grade IV (7.6%). The side effects were mainly manifested as bone marrow suppression, liver and kidney injury, and myocardial injury after chemotherapy. Among those with grade IV side effects, eight cases had a hemoglobin count of <65g/L and/or a platelet count of $<25\times10^9$/L and improved after a component blood transfusion. In addition, 32 cases (accounting for 24.2%) had transient liver and kidney dysfunction, which improved after symptomatic treatment, such as protecting the liver and kidneys. One case had a severe myocardial injury with a BNP of 1068pg/mL. The electrocardiogram showed a prolonged QT interval with non-specific ST-T segment changes, and there were no obvious abnormalities in the Color Doppler echocardiography (with the ejection fraction of 65% and a fraction shortening of 34%) and isoenzymes of creatine kinase. Drugs that might affect the myocardial function were immediately stopped. After active myocardial nutrition therapy, the BNP gradually returned to the normal range, and the electrocardiogram improved. All cases were examined regularly for distortion product otoacoustic emission during chemotherapy, and no obvious abnormalities in speech and hearing were found. There were no occurrences of secondary tumors after chemotherapy in the present study.

Discussion

In recent years, with the continuous improvement of the level of diagnosis and treatment, the prognosis of HB has been greatly improved. Hafberg et al[10] showed that the current five-year OS rate of pediatric patients with HB could reach 75%, and the five-year EFS rate reached approximately 65–70%. In the present study, HB in infants under one-year-old (the median age of 8.40 months) was investigated with a median follow-up duration of 58 months. The results showed that the five-year OS rate was 80.1% and the EFS rate was 77.5%, both of which are higher than those reported in the literature, which suggests a relatively good prognosis for infants with HB. Angela and Beate[3,4] also believed that congenital or infantile HB would have a better prognosis through investigation.

Some foreign researchers have conducted studies on pediatric patients with HB found during pregnancy and diagnosed after birth. They found that children with a low birth weight, especially with a very low birth weight of

less than 1000g, were more prone to develop HB in the future.[11] Furthermore, studies have shown that certain factors, such as maternal age, hypertension during pregnancy, excessive weight, excessive amniotic fluid, and a history of smoking, will increase the incidence of HB.[12,13] In the present study, three cases of HB found during pregnancy included infants with low birth weights combined with other risk factors (advanced maternal age, maternal hypertension, a history of smoking, etc.), which were consistent with the opinions of foreign researchers. Six test-tube babies in the present study were also diagnosed with HB during infancy, and three of them were fraternal twins. Although no research has proved that test-tube babies, twins, or multiple pregnancies might increase the risk of HB, it should be noted that the above-mentioned pregnancy status was prone to cause excessive amniotic fluid in the fetus, thus increasing the risk of complications during pregnancy. These factors might also increase the probability of HB in infants delivered by in vitro fertilization and multiple pregnancies.

Studies have shown[14] that the peripheral platelet count may increase in case of infections, malignancies, and some chronic diseases. In the present study, more than half (56.8%) of the cases had elevated platelet counts. However, through risk factor analysis, the elevation of platelets was not significantly correlated with the prognosis of infants with HB, which was not consistent with the data reported in the literature. Although, it might be correlated with a smaller sample size.

AFP is a special protein in the blood produced by the liver. At present, both domestic and foreign experts have reached a consensus that AFP is an important tumor marker of HB. Not only is the level at the initial diagnosis of great significance to the prognosis, but it may also act as an important indicator of the therapeutic effect observed during the process of treatment. Zhao W proposed that a low level of AFP at the first visit is an indicator of poor prognosis.[15] The results of the present study show that the prognoses were relatively good in those with infantile HB who have a relatively high level of AFP. However, the prognoses of pediatric patients with AFP<100ng/mL were poor, which was consistent with relevant foreign reports. The latter type of pediatric patients was often insensitive to chemotherapy and prone to relapse, leading to shortened survival. It should be noted that some normal full-term newborns may also have higher levels of AFP. These need to be differentiated from neonatal HB, as the former mostly fall to the normal range within 2–3 months after birth. HCG is secreted and synthesized by the trophoblast cells of the placenta, which can stimulate the fetal testes to secrete testosterone and promote male differentiation.[16] In rare cases, the tumor cells in HB can secrete hCG, leading to precocious puberty, which is more common in boys. Malati[17] believed that the increased secretion of hCG was not a common phenomenon in HB, that there was no clear relationship between the level of hCG and the prognosis of HB, and that the appearance of precocious puberty was even rarer. Currently, the domestic and foreign reports of precocious puberty caused by hCG in pediatric patients with HB were mainly cased reports. The case of HB with precocious puberty caused by elevated hCG in our center was a boy. After comprehensive treatment, the blood hCG gradually decreased, suggesting that the level of hCG might become another important biological marker of HB after AFP. However, a larger sample of clinical data is still needed for a follow-up study and verification.

Marcio[18] believed that the prognosis of the pediatric patient with the pathology of simple fetal type was good, and long-term survival could be achieved if the tumor could be completely removed, even without additional chemotherapy. Another study[19] showed that the pathological classification of a small cell undifferentiated type might often have a significant adverse effect on the prognosis because small cell undifferentiated HB has the characteristics of rhabdoid tumors. Concerning the distribution of pathology in the present study, the epithelial type was predominant in infantile HB. Among the epithelial types, the fetal type with better prognosis was the most common one, which was consistent with reports in the literature. Although the final statistical results of the present study failed to support the correlation between the pathological classification and prognosis (P>0.05), the two cases with small cell undifferentiated types in the present study eventually died. Through retrospective studies, the SIOPEL believes that the PRETEXT staging can predict the resectability of tumors to a certain extent.[20] The impact on the prognosis is very important because the complete resection of liver tumors is the key to the treatment of HB in childhood. The data in the present study shows that the EFS rates of pediatric patients with PRETEXT stage IV was significantly lower than that of children with other stages, which also confirms that the PRETEXT stage is significantly correlated with the prognosis.

Systemic metastasis may occur early during the disease in infantile HB. Similarly to older children with HB, the lung is the most common metastasis site. Because it comes

from the bloodstream, it is most likely to occur at the edge of the lung or the terminal vascular supply area,[21] which can be visible as nodule opacity of the outer parts of lungs in imaging. Among the 45 cases with distant metastases in the present study, 86.7% occurred in the lung, which was consistent with the literature. Other metastatic sites included the brain, bones, etc. It is worth mentioning that there was a case of HB with a right atrial tumor thrombus in the present study. Because of the extremely fast flow of blood in the heart and large blood vessels, tumor cells are difficult to stop in regard to the formation of tumor thrombi in these areas. Therefore, it is relatively rare in domestic reports. Unfortunately, despite active treatment, the case eventually died of ventricular fibrillation caused by a collapse of the atrial thrombus. Due to the rich blood supply in the liver, HB is prone to cause intrahepatic metastasis, forming multiple intrahepatic foci and venous tumor thrombi. If it is not cleaned thoroughly, it is prone to result in tumor recurrence and distant metastasis.[14] The results of the present study show that the prognosis of HB with distant metastasis and multiple intrahepatic foci was relatively poor, which was consistent with foreign literature reports.[22]

Infantile HB is sensitive to chemotherapy.[23] Although multidisciplinary treatments, such as surgery, interventional therapy, targeted therapy, and immunotherapy are gradually being developed, surgical resection combined with chemotherapy is still the main therapeutic option. Preoperative chemotherapy can effectively shrink the tumor and create opportunities for the complete resection of the tumor. Postoperative consolidation chemotherapy can also effectively prevent the recurrence of residual tumors and improve the cure rate. However, the resistance of chemotherapy drugs is still an important limitation in the management of HB children. Therefore, it is particularly important to select the best combination for different chemotherapy drugs to promote individualized treatment.[24] Cases in the present study were mainly treated with chemotherapy combined with surgery. Individualized chemotherapy was used for high-risk cases with repeated recurrence, distant metastasis, tumor thrombosis, and refractory disease, and good clinical effects were achieved. According to the WHO classification standard for toxic and side effects of chemotherapy, the systemic side effects of chemotherapy in infants with HB in the present study were mainly concentrated in grade II, and the proportion of grade IV was not high. This might be correlated with the strong metabolism and regeneration ability in infancy, together with a strong tolerance to drugs in chemotherapy. It could also be suggested that the chemotherapy regimen in the present study was safe. However, due to the young age and the imperfect development of various organs in infants, the drugs in chemotherapy (especially platinum) can cause injury to liver and kidney functions, hearing, etc. Anthracyclines can also cause injury to the heart and even increase the risk of secondary tumors. Therefore, regular evaluation of organ function was required to ensure the safety of the medication. Studies have shown that APBSCT can improve the prognosis of advanced HB.[25] Our center has performed APBSCT treatments on a three-year-old pediatric patient with HB, which significantly prolonged the survival of the patient. However, it has not been used in a case of infantile HB, yet our center is expected to conduct related treatments in infants in the future.

In recent years, liver transplantation has been successful in the treatment of unresectable pediatric patients with HB in stage IV. It has been reported in the literature that the five-year survival rate is close to 85%.[26] In the present study, one case of infantile HB with multiple tumors in the liver still had poor results after conventional surgery, chemotherapy, and arterial interventional embolization. At the age of 8 months, a living donor liver transplantation was successfully performed. After transplantation, consolidation chemotherapy was conducted for two cycles. Then, the regular recheck of AFP and imaging examinations all indicated CR.

Conclusion

In summary, the cases of infantile HB in this study showed corresponding characteristics. Through comprehensive treatments, such as chemotherapy and surgery, the prognoses of infantile HB were relatively good. However, they were still vulnerable to multiple factors, such as tumor features leading to different AFP levels, PRETEXT staging, the existence of distant metastases, and multiple intrahepatic loci. Meanwhile, the present study only included the diagnosis and treatment data collected by a single center of the Beijing Tongren Hospital. Therefore, the number of cases was still small. More clinical data and multi-center joint research will be collected in the future to provide a clinical reference for the multidisciplinary treatment of infantile HB.

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Disclosure

The authors report no conflicts of interest in this work.

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