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Unusual Twin Anemia-polycythemia Sequence in a Dichorionic Diamniotic Pregnancy. A Case Report and Systematic Review

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Abstract

Objective: *Twin Anemia Polycythemia Sequence is a serious complication of monochorionic twin pregnancy, however in dichorionic pregnancy is an uncommon complication. Although this is extremely rare, we would like to emphasize the need for the medical community to acknowledge that in some cases, a sequence of anemia and polycythemia may occur in dichorionic twins, as well as other blood flow imbalances and we should always take this into consideration.*

Data Sources: *We carried out a systematic search in multiple databases, including PubMed, Scopus, and Medline/Embase from a time period involving the last 5 years from 2024.*

Study Selection: *Only data from case reports were found and therefore included for the analysis.*

Data Extraction and Synthesis: *The subject-related articles were processed according to Preferred Reporting Items in Systematic Reviews and Meta-Analyses (PRISMA) guidelines. We evaluated five case reports.*

Results: *Two of the five clinical cases fully met both the prenatal and postnatal criteria for TAPS. The remaining cases partially met these requirements. Tests to determine zygosity are extremely important in the case of dizygotic twins, as they allow for increased vigilance in detecting complications at an early stage of twin pregnancy.*

Conclusions: *With an understanding of the type of zygosity in dichorionic twin pregnancies, it becomes possible to anticipate complications typical of monochorionic pregnancies. This information is essential and may become a valuable tool in managing and preventing complications in both antenatal and neonatal care.*

Keywords: twin anemia-polycythemia sequence; TAPS; dichorionic pregnancy

Introduction

Certain pregnancy complications are exclusively associated with monochorionic (MC) pregnancies, while they are not linked to the dichorionic (DC) pregnancies at all. This is principally a reference to feto-fetal blood flow such as twin to twin transfusion syndrome (TTTS), twin anemia polycythemia syndrome (TAPS) and other ones which stems from the presence of a common placental mass with shared intertwin placental circulation. These intertwin anastomoses are implicated in TTTS and TAPS pathophysiology. TAPS is the consequence of small arteriovenous (AV) anastomoses (< 1 mm in diameter) connecting the placental vessels of the twins. It develops in approximately 3-5% and even up to 10 to 15% of MC twin pregnancies and up to 13% following laser therapy for TTTS, although high quality data are lacking to support a precise incidence [1,2]. For this reason we should not forget that the incidence of TAPS also applies to DC pregnancies and if not taken into consideration, the perinatological as well as neonatological consequences can be devastating, including stillbirth and neonatal death.

The rate of blood flow through these vessels has been estimated to be around 5 to 15 ml per day, allowing for some degree of fetal compensation, at least in the earlier stages of the disease [2]. Perhaps for this reason, discordance of amniotic fluid volume in twins is not a typical feature of this presentation.

TAPS is defined by the presence of cerebral Doppler anomalies, with peak systolic velocity (PSV) of the middle cerebral artery

(MCA) various cut-off points. Recently, some researchers have suggested that the antenatal diagnosis of TAPS should be based on a differential PSV MCA between twins greater than 0.50 MoM [2]. Moreover, TAPS can be postnatally confirmed based on the difference in the values of hemoglobin concentrations of >8 g/dL or more and either 1) reticulocyte index >1.7 between donor and recipient or 2) the identification of exclusively small-vessel anastomoses (<1 mm) upon placental pathology examination [2].

Eventually an imbalance in blood flow between the fetuses may result in antenatal and perinatal complications, including death of the twin(s). The donor twin develops anemia and may have growth restriction, and the recipient twin has polycythemia and may develop heart failure, leading to fetal hydrops.

We present a rare case of a DCDA pregnancy complicated with TAPS, of which only five cases have been reported so far. Antenatal and postnatal exponents are shown in Table 1. and Table 2., respectively.

Table 1: Antenatal staging of twin anemia-polycythemia sequence.

Stage	Criteria	Intertwin criteria
1	MCA-PSV >1.5 MoM in donor and MCA-PSV <1.0 MoM in recipient	Δ MCA-PSV >0.5 MoM without cardiac compromise of donor
2	MCA-PSV >1.7 MoM in donor and MCA-PSV <0.8 MoM in recipient	Δ MCA-PSV >0.7 MoM without cardiac compromise of donor
3	Stage 1 or 2 with cardiac compromise of donor, defined as critically abnormal flow[a]	
4	Ascites or hydrops of donor	
5	Single or double fetal demise	

MCA-PSV, middle cerebral artery Doppler peak systolic velocity; MoM, multiples of the median.
[a] Cardiac compromise defined as absent or reversed end-diastolic flow in umbilical artery, pulsatile flow in umbilical vein, or reversed a-wave in the ductus venosus.

Adapted from Society for Maternal-Fetal Medicine. Twin-twin transfusion syndrome and twin anemia-polycythemia sequence. Am J Obstet Gynecol 2024 a Tollenaar et al., 2019 [2,3].

Table 2: Postnatal twin anemia-polycythemia sequence staging.

Stage	Criteria
1	The hemoglobin difference between the twins is >8.0 g/dL
2	The hemoglobin difference between the twins is >11.0 g/dL
3	The hemoglobin difference between the twins is >14.0 g/dL
4	The hemoglobin difference between the twins is >17.0 g/dL
5	The hemoglobin difference between the twins is >20.0 g/dL

This staging include reticulocyte index >1.70 between donor and recipient and the identification of exclusively small-vessel anastomoses (<1 mm) upon placental pathology examination.

Adapted from Society for Maternal-Fetal Medicine. Twin-twin transfusion syndrome and twin anemia-polycythemia sequence. Am J Obstet Gynecol 2024 [2].

Search Strategy

The review was prospectively registered in PROSPERO (CRD42025597378) on 17th January, 2025 (before data extraction) and PRISMA guidelines were followed. PubMed, Scopus and Embase/Medline were searched from a time period encompassing the last 5 years from 2024 for the following terms: "twin anemia-polycythemia sequence", "TAPS" and "dichorionic diamniotic pregnancy".

A total of forty eight articles were found. Of these, there were 22 duplicates, which were excluded from the analysis. Following abstract screening, 26 full-text articles were reviewed, which resulted in 5 relevant manuscripts at the end of the search. This included 5 case reports. No review articles were found. Furthermore, the reference lists of included manuscripts were screened to ensure no articles were missed. Each report was assessed independently by two authors.

The population that was studied comprised pregnant women in dichorionic diamniotic twin pregnancy complicated exclusively by TAPS. The exclusion criteria were singleton pregnancies, monochorionic diamniotic (MCDA) and monochorionic monoamniotic (MCMA) twin pregnancies complicated with TTTS and other fetal flow imbalances disorders.

Data Extraction

Data from the eligible studies were extracted and assessed by two independent reviewers. The data that were extracted from the full texts included, but was not limited to the gravidity, parity, mode and timing of delivery. Additionally, neonatal

outcomes were analyzed, such as Apgar score at 1 and 5 minutes, birth weight, sex of the newborn twins, necessity of a partial volume exchange transfusion and blood transfusion in twins. The PRISMA chart of the whole process was created (Figure 1.).

Figure 1: PRISMA flow chart of the systematic review.

Quality Assessment

The methodological quality of the included studies was assessed using the ROBVIS (visualization tool for risk of bias assessments in a systematic review; QUADAS-2, a revised tool for the quality assessment of diagnostic accuracy studies). The data are depicted on Fig. 2. and Fig. 3. (Appendix).

Data Synthesis

We summed up data in appropriate tables and used mean values to represent the records. Furthermore, the data were divided into multiple categories, of which the most relevant were those containing information regarding the TAPS exponents diagnosed during pregnancy and postpartum as well as histopathological examination of the placenta. All the results were calculated to two decimal places by using general rounding rules.

Case Presentation

A 29-year-old Caucasian woman, primigravida in dichorionic diamniotic twin pregnancy was referred by the attending physician to the outpatient clinic at 24 weeks of gestation due to early-onset FGR (Fetal Growth Restriction) of the fetus I. Pregnancy was complicated by gestational diabetes type 1.

The dichorionic nature of the pregnancy had been unequivocally established in the first trimester of pregnancy after demonstration of a lambda sign.

At the beginning, in at outpatient clinic it was observed FGR with reversed end-diastolic velocity of the umbilical artery (REDV) with normal pulsatility index (PI) in the ductus venosus (DV) in case of the first twin.

A fortnight later oligohydramnios was observed, additionally to multiples to median (MoM) in peak systolic velocity in the middle cerebral artery (PSV MCA) difference above 0.50 (precisely 0.63 MoM) between fetuses with a recommendation to check-up in 7 days.

Thereafter, ultrasound imaging demonstrated discrepancy in estimated fetal weight 48%. Additionally, imaging tests showed cardiomegaly with fluid in the pericardial cavity and edema of the placental plate with concomitant oligohydramnios of the fetus I.

It is noteworthy that fetus II was eutrophic, UA and MCA vascular flow spectra were normal, and most importantly the amount of amniotic fluid throughout the pregnancy was correct.

Based on these features the pregnant woman at 27+3 weeks of gestation was referred to the hospital. Woefully, the suspicion of an unbalanced feto-fetal transfusion was not raised.

During hospital stay at 28 weeks' gestation anhydramnios with the concurrent appearance of placenta insufficiency were observed in case of first twin. Baseline sFlt-1/PLGF ratio was 70, reaching a maximum value of 94. In laboratory tests, gradually increasing proteinuria was noted. Preeclampsia was diagnosed at the time. In the meantime, blood pressure values were normal. Moreover, due to uterine contraction activity tocolysis was administered. A decision has been made to implement subsequent cycle of steroids.

In a short period of time, there were an incremental drop in platelet count, hematocrit, and fibrinogen values with a simultaneously increase in liver enzymes, D-dimer, uric acid, and lactate dehydrogenase. The pregnant woman complained about increasing swelling of the face, hands and lower extremities and decreased micturition than usual.

It was 29 weeks of gestation the decision was made to implement magnesium sulfate for neuroprotection. At that time, ultrasonography scans showed PI DV >95 centile. It was decided to undertake delivery by emergency cesarean section on account of the developing HELLP syndrome.

The first female infant was 550 g with Apgar score 1 and subsequent need for intubation. Then, a 1300-g baby girl was delivered in cephalic presentation. Apgar score was 6/8, at 1 and 5 minutes, respectively. Unfortunately, due to the urgency of the obstetric situation, pathological examination of the placenta was not performed, however there were no visible communicating vessels between placentas.

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Table 3: Clinical characteristics of the neonates in the 1st day of life.

Characteristics	Twin I	Twin II
Weight (g)	550	1300
Lenght (cm)	27	37
Head circumference (cm)	23	27
General appearance	pale skin, lethargy	red skin, hydrops, tremors, tachypnea
Blood transfusion on day 1	yes	no
Partial exchange blood transfusion on day 1	no	yes
Neonatal death	3rd day of life	no
Peripheral blood component/ Reference ranges	Patient's laboratory values	
WBC (G/l)	2,44	5,42
RBC (T/l)	0,90	4,92
Hemoglobin (g/dl) 15,16-23,97	4,99	24,5
Hematocrit (l/l) 0,44-0,80	0,157	0,688
MCV (f/l) 98-122	174	135
Blood smear	Polychromatophilia =+++; Anisocytosis=+++ nucleated red blood cell=632,8/100WBC; Schistocytes=++	Polychroma tophilia=++; Anisocytosis =+++ nucleated red blood cell 26,4/100WBC
PLT (G/l) 150-192	79	136
NT-proBNP (pg/ml) <125	19404,0	4182,0

Results and Discussion

We report an extraordinary case of TAPS in a dichorionic twin pair. TAPS is known to result from chronic blood flow through minuscule placental anastomoses. It was once thought to be a disease entity typical of monochorionic pregnancies. Nowadays, scientific reports show that in some cases, placental anastomoses can be present in dichorionic twins as well, potentially leading to TAPS and severe consequences.

In our case TAPS was confirmed postnatally, on the basis of the twins' clinical features at birth and some exponents in laboratory tests according to SMFM (Society for Maternal-Fetal Medicine). Twin II was plethoric and in the complete blood count (CBC) occurred polycythemia. Hematocrit (Ht) and hemoglobin levels (Hgb) were 68% and

24.50 g/dl, respectively. The co-twin was pale, and developed anemia. Blood count revealed Ht and Hgb levels equal to 16% and 5 g/dl, respectively, fulfilling the postnatal criteria of TAPS. Discrepancy between hemoglobin values was >17.0 g/dL, which constituted stage 4 of TAPS diagnosed at birth. In case of the first twin reticulocytes count was elevated approximately two and a half times greater, totaling 259 x 10^9 /L

(normal range 25-102 x 10^9 /L). Woefully, the reticulocyte count in case of the second twin was not measured. Besides, we also noted low leukocyte 2.44 × 10^9 /L (normal range 9.40-34 x 10^9 /L) and platelet count 79× 109/L (normal range 192-213 x 10^9/L) in the first twin, which allowed the recognition of pancytopenia.

Based on the large difference in hemoglobin concentration and increased reticulocyte count in the anemic infant a sequence of twin polycythemic anemia was diagnosed, with twin I being a TAPS donor and twin II being a TAPS recipient. However, postnatal criteria for TAPS are not satisfied as reticulocyte count and/or dye studies of the placenta were not performed due to clinical circumstances.

Unfortunately, in our clinical case antenatal suspicion of TAPS was not raised, despite the large difference in MCA-PSV between fetuses. Our twins had a MCA-PSV of 1.47 MoM and 0.44 MoM, twin I and II, respectively. The recipient polycythemic twin met the ISUOG/SMFM criteria for TAPS of MCA-PSV <0.80 MoM. However, our donor anemic twin did not meet criteria of MCA-PSV >1.5 MoM. Nonetheless, the difference between twins was ΔMCA-PSV >0.7 MoM with reversed end-diastolic velocity of the umbilical artery, meeting current ISUOG/SMFM antenatal criteria for TAPS stage 2/3 (Table 1.).

Nevertheless, we believe it still represents a likely diagnosis of TAPS as it does fulfill new proposed criteria, where the difference in the MCA-PSV between the donor and recipient twin is used.

Tollenaar et. al propose a difference in the MCA-PSV between the donor and recipient twin of >0.5 MoM which provides better sensitivity and higher diagnostic accuracy when compared to separate anemia and polycythemia cut-offs, and thus improved detection of cases antenatally [3]. Khalil et al. agree, reporting a consensus of expert opinions with the conclusion that the addition of middle cerebral artery (MCA) peak systolic velocity (PSV) discordance to the pre-existing MCA-PSV criterion for antenatal diagnosis of TAPS is likely to impact clinical practice significantly by identifying more TAPS cases [4].

The disparity in echogenicity of the placentas on ultrasound examination and prominent color difference in the placentas after delivery support the diagnosis of TAPS, yet these do not represent the diagnostic criteria.

In the five cases we analyzed from the past five years, only two cases met completely both antenatal and postnatal criteria for TAPS (Tab. 4). The remaining cases partially fulfilled the aforementioned criteria. Zilliox et al. described a case of TAPS, which developed in twins diagnosed to be DC in first trimester and confirmed by placenta histopathology [5]. All ISUOG/SMFM antenatal and postnatal diagnostic criteria were proposed to be fulfilled, including MCA-PSV, laboratory exponents, and the presence of anastomoses on dye studies. However, it should be noted that the placental dye studies noted several individual arteriovenous anastomoses, the mean diameter of which was 3.50 mm, which were dissimilar to the small <1 mm anastomoses that are typical of TAPS. Similarly, all criteria for the diagnosis of TAPS were followed in the work of Jeyaseelan et al. [6]. In contrast to the work of its predecessors, no macroscopic or microscopic evidence of vascular communication between placental plates were found, notwithstanding that the placental masses were distinct. In the studies of Lee et al. and Tollenaar et al. middle cerebral artery peak systolic velocity ultrasound Doppler measurements were not performed, which directly excluded the diagnosis of TAPS prenatally [7,8]. These recordings were not carried out, because in the first case an emergency cesarean section was performed, and in the second case an ultrasound examination revealed normal amniotic fluid and adequate linear growth for both fetuses. The authors only based on the discrepancies in hemoglobin values between neonates and the appearance of the twins at birth to conclude, that TAPS was present. The reticulocytosis ratio was not calculated, and the histopathological examination of the placenta was not performed due to the urgency of the obstetric situation and excessive fluid leakage from the vessels into the adjacent placental tissues, respectively, failing to satisfy the TAPS criteria (Table 4). According to the paper by Kanagaretnam et al. TAPS was suspected due to the inter-twin discordance in MCA PSV of 0.74 MoM [9]. Likewise, like its predecessors, the diagnosis was established on the basis of laboratory exponents, apart from the measurement of reticulocytosis ratio. Placenta examination has not been carried out due to pathology services issues. A summary of the analyzed cases is provided in the Tables 4. and 5.

The existence of a mutual placenta plate with shared intertwin placental circulation is essential for the development and management of complications unique to MC gestations, such as TAPS and others. As it appears, complications typical of MC pregnancies are also found in DC pregnancies and should be kept in mind. This common vessels between fetuses, called anastomoses are implicated in TAPS and other flow imbalances pathophysiology.

Approximately one third of spontaneously occurring twins are monozygotic (MZ) and two-thirds of MZ twins are monochorionic, possessing a single placenta [2].

Chorionicity refers to the type of placentation in multiple gestations, which partly depends on zygosity [2]. Zygosity refers to type of conception, meaning that monozygotic or identical twins result from mitotic division of zygote originating from fertilization of 1 ovum by 1 sperm and dizygotic or nonidentical twins are result of multiple ovulations, with 2 sperm fertilizing 2 ova. The chorionicity of monozygotic twins depends on when cleavage occurs relative to fertilization.

In about 30% of monozygotic twin gestations, cleavage of the morula within 4 days of fertilization will result in DC placentation. In major of the remaining two-thirds of monozygotic twin gestations, cleavage of the more advanced blastocyst occurs between 4 and 8 days after fertilization, resulting in MCDA twins.

Surprisingly, it should be noted, that in one analyzed case study color dye studies found no vascular communication between placental plates among the fetuses and in one case individual arteriovenous anastomoses were reported [5,6]. Zygosity was not tested in the study by Zilliox et al. In the paper by Jeyaseelan et al. monozygosity was confirmed. To our astonishment Lee et al. confirmed dizygosity [7].

We remain in agreement with the suggestion proposed by the Kanagaretman et al. that testing to determine zygosity is of utmost importance in dichorionic twin cases, especially when the physician does not expect complications typical of MC pregnancies. The accurate prenatal diagnosis of chorionicity is of major clinical importance in the management of twin pregnancies as far as it allows provision of increased surveillance in twin pregnancies and detection of complications in their early stages.

The lambda sign was determined in our case in the first trimester of pregnancy. Nevertheless, the twin peak sign has some limitations. We also have in mind that the lambda sign tends to disappear with advancing gestational age therefore, it becomes less reliable beyond the first trimester [2]. Moreover, its sensitivity and specificity for the prediction of DC pregnancy are 99% and 95%, respectively, which means that it is present in as many as 5% of MC pregnancies [10]. Reverse misdiagnoses of DC as MC pregnancies prior to 14 weeks of gestation are also encountered in medical practice [11]. In the paper by Dziennik et al., as much as 4 pregnancies were misdiagnosed during the early ultrasound scan as high-risk MC gestations, but were found to be DZ by DNA testing, which may be explained as a result of fusion of DZ placentas [12,13]. Two separate placental masses are also indicative of low-risk DC pregnancy, but they are seen only in about one-third of twin pregnancies [12].

A cell-free DNA testing, that analyzes single-nucleotide polymorphisms has been marketed to screen for aneuploidy in twin pregnancies, with the added ability to provide zygosity information. However, a recent study observed accurate zygosity prediction in 100% of cases for which testing yielded results, zygosity is not a substitute for chorionicity given that a subset of monozygotic twins will be dichorionic [2,14].

Table 4: Cases of twin anemia polycythemia syndrome in DCDA pregnancies in the literature to date.

No.	Author, year, type of study	Zygosity	Antenatal TAPS exponents	Postnatal TAPS exponents	Histopathological examination of the placenta
1	Jeyaseelan et al., 2023, case report	Monozygotic-confirmed (two male neonates).	• At 27 weeks gestation-in the larger twin there was mild ascites, cardiomegaly, enlarged echogenic placenta. Increased fetal MCA PSV to 65 cm/s (1.80 MoM). • The smaller twin had reduced amniotic fluid volume, congested looking liver, and reduced MCA PSV at 17 cm/s (0.50 MoM). • The inter-twin discordance in MCA PSV equaled 1.30 MoM.	• One twin was pale and required blood transfusion due to hemoglobin of 5.60 g/dL. • The co-twin was plethoric and had a partial volume exchange transfusion due to hemoglobin of 24.90 g/dL. • Hemoglobin discordance 19.30 g/dL.	• The placental masses were distinct. • No macroscopic or microscopic • evidence of vascular communication between placental plates.
2	Lee et al., 2022, case report	Dizygotic-confirmed (opposite sex of the neonates).	• Middle cerebral artery peak systolic velocity ultrasound Doppler measurements were not performed.	• One twin was pale and required blood transfusion due to hemoglobin of 7.80 g/dL. • The co-twin was plethoric and had a partial volume exchange transfusion due to hemoglobin of 22.20 g/dL. • Hemoglobin discordance 14.40 g/dL.	• The placenta was macroscopically fused. • One part of the placenta was pale, while the other was dark red. • The vascular connection of the placenta was not confirmed due to the urgency of the obstetric situation.
3	Tollenaar et al., 2021, case report	No data available on zygosity. Two male neonates.	• Middle cerebral artery peak systolic velocity ultrasound Doppler measurements were not performed	• One twin was pale due to hemoglobin of 9.80 g/dL. • The co-twin was plethoric due to hemoglobin of 22.40 g/dL. • Hemoglobin discordance 12.60 g/dL. • Reticulocytes count was 72‰ in twin II. The reticulocyte count in • twin I was not measured.	• One part of the placenta was pale, while the other was dark red. • Inconclusive results regarding the presence of anastomoses due to excessive fluid leakage from the vessels into the adjacent placental tissue.
4	Kanagaretnam et al., 2021, case report	No data available on zygosity as well as the sex of the infants.	• Twin 1- MCA PSV was 26 cm/s at 0.56 MoM. • Twin 2- MCA-PSV 50.90 cm/s • at 1.30 MoM. • Twin 1 had a normal-appearing • placenta, and twin 2 demonstrated an echogenic and thickened placenta. • The inter-twin discordance in MCA PSV equaled 0.74 MoM. • The above ultrasound findings raised the suspicion of a diagnosis of TAPS.	• Twin I had a formal hemoglobin of 26.60 g/dL, reticulocyte count of • 291 × 109, and reticulocyte percentage of 4.50%. • Twin II was pale and hemoglobin of 4.90 g/dL. A reticulocyte count in twin 2 was not performed.	• Due to pathology services issues, dye studies were unable to be performed. • One part of the placenta was darker with a pale nodule of villous infarction, and the other part was pale with a thin cord and immature villi.

5	Zilliox et al., 2019, case report	No data available on zygosity as well as the sex of the infants.	• Increased MCA PSV of 72 cm/s at 1.71 MoM and signs of cardiac decompensation (generalized fetal edema, significant subcutaneous edema and pleural effusion) in twin I. • MCA PSV twin II of 17 cm/s at 0.40 MoM. • The inter-twin discordance in MCA PSV equaled 1.31 MoM.	• Twin I- extreme pallor, the hemoglobin level was 2.40 g/dL with 103 100 reticulocytes per mm3 and a reticulocytosis rate of 17.50%. • Twin II- plethoric, hemoglobin level was 20.90 g/dL, with reticulocytes 329 x 109 and a reticulocytosis rate of 5.80%. • Intertwin differential of 18.50 hemoglobin units and reticulocytosis ratio of 3.30.	• Several individual arteriovenous anastomoses, the mean diameter of which was 3.50 mm. • One part of the placenta was pale, while the other was dark red. • The placenta was macroscopically distinct.
6	Our clinical case, 2024, systematic review	No data available on zygosity. Two female neonates.	• MCA PSV of 50.24 cm/s at 1.47 MoM and signs of cardiac decompensation (cardiomegaly with fluid in the pericardial cavity) and edema of the placental plate in twin I. • MCA PSV of 15.79 cm/s at 0.44 MoM twin II. • The inter-twin discordance in MCA PSV equaled 1.03 MoM.	• The co-twin was plethoric and had a partial volume exchange transfusion due to hemoglobin of 24.50 g/dL. A reticulocyte count was not performed. • Twin I was pale and required blood transfusion due to hemoglobin of 5 g/dL, with reticulocytes 259 x 109 and a reticulocytosis rate of 28.78%. • Hemoglobin discordance 19.50 g/dL.	• One part of the placenta was pale, while the other was dark red. • The histopathological examination of the placenta has not been performed due to the urgency of the obstetric situation.

Table 5: Characteristics of analyzed cases.

No.	Author, year, type of study	Patient's age [yo, years old] / Gravida/Para	Additional pregnancy complications	Mode and timing of delivery [weeks of gestation]	Indication for cesarean section	Apgar score at 1 and 5 minute	Birth weight [g, grams]
1	Jeyaseelan et al., 2023, case report	31 yo G3P3	none	Cesarean section, 29	Small for gestational age fetuses and worsening anemia and polycythemia in the fetuses.	No data	I-1140 II-1259
2	Lee et al., 2022, case report	36 yo G1P1	hypothyroidism, gestational diabetes	Cesarean section, 31	CTG recording revealed minimal variability in the first fetus, but the heart rate of the second one showed late deceleration.	I-2/6 II-4/7	I-1940 II-2360
3	Tollenaar et al., 2021, case report	22 yo G3P1	none	Cesarean section, 33	Fetal distress on CTG registration.	I-3/9 II-5/8	I-1962 II-1994
4	Kanagaretnam et al., 2021, case report and review of the literature	34 yo G2P1	Tetralogy of Fallot and early-onset growth restriction in twin 2, in addition to onset of preeclampsia at 30 weeks gestation	Cesarean section, 32	Fetal distress on CTG registration.	No data	No data However, twin 1 demonstrated adequate interval growth, with an estimated fetal weight (EFW) 1904 g. Twin 2 EFW 1128 g, abdomen circumference <5th centile.
5	Zilliox et al., 2019, case report	35 yo G3P2	None	Cesarean section, 31	Fetal distress on CTG registration.	No data	I-1725 II-1554
6	Our clinical case, 2024, systematic review	29 yo G1P1	gestational diabetes and early-onset growth restriction in the twin I, in addition to onset of preeclampsia at 29 weeks gestation	Cesarean section, 29	HELLP syndrome.	I-1/intubation II-6/8	I-550 II-1300

Strengths and Limitations

The main strength of our analysis is the identification and documentation of a rare and unusual complication occurring in dichorionic twins, which might otherwise have been overlooked. In addition, we have proposed a hypothesis regarding the identification of zygosity in dichorionic pregnancies as a helpful and unique tool in predicting the occurrence of fetal flow imbalances, such as TAPS, as a basis for formulating new hypotheses that can then be piloted in more stringent studies.

We hope that, in time, they will enable in-depth analysis from multiple perspectives, providing rich qualitative data that ensures a deeper understanding of the background.

Unfortunately, there are some limitations. The results of single-case studies cannot be generalized to the entire population, as they may represent extraordinary variations from the norm rather than typical events. Furthermore, the subjective interpretation of events by researchers can lead to a situation where personal opinions influence the data and conclusions. There is therefore a risk of overinterpreting the results of single-case studies, which can lead to incorrect findings.

The retrospective nature of cases only exacerbates misinterpretation and limits the robustness of the evidence.

Conclusions

We suggest that clinicians pay attention to the possibility of TAPS and other fetal flow imbalances in a dichorionic twin pregnancy in case of the occurrence of adverse pregnancy outcomes due to the possibility of not making a timely diagnosis of TAPS. In our opinion, the knowledge of monozygosity in dichorionic twin pregnancies is needed and may become a helpful tool to guide both prenatal and postnatal care and predict the occurrence of complications typical of monochorionic pregnancies. Reporting such cases is utmost priority, because it reminds physicians to bear in mind that, though rare, TAPS and other complications typical of MC pregnancies can also occur in DC twins.

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References

1. da Silva Rocha J, Guedes-Martins L, Cunha A. (2023). Twin Anemia-Polycythemia Sequence (TAPS): From Basic Research to Clinical Practice. *Curr Vasc Pharmacol.*;21:91-105. DOI : 10.2174/1570161121666230131112930.
2. Society for Maternal-Fetal Medicine (SMFM); Miller RS, Miller JL, Monson MA, Porter TF, Običan SG, Simpson LL; (2024 Oct). SMFM Publications Committee. Electronic address: pubs@smfm.org. Society for Maternal-Fetal Medicine Consult Series #72: Twin-twin transfusion syndrome and twin anemia-polycythemia sequence. *Am J Obstet Gynecol.*;231:B16-B37. DOI: 10.1016/j.ajog.2024.07.017. Epub 2024 Jul 18.
3. Tollenaar LSA, Lopriore E, Middeldorp JM, Haak MC, Klumper FJ, Oepkes D, Slaghekke F. (2019, Jun). Improved prediction of twin anemia-polycythemia sequence by delta middle cerebral artery peak systolic velocity: new antenatal classification system. *Ultrasound Obstet Gynecol*, 53:788-793. DOI: 10.1002/uog.20096. Epub 2019 May 6.
4. Khalil A, Gordijn S, Ganzevoort W, Thilaganathan B, Johnson A, Baschat AA, Hecher K, Reed K, Lewi L, Deprest J, Oepkes D, Lopriore E. (2020 Sep). Consensus diagnostic criteria and monitoring of twin anemia-polycythemia sequence: Delphi procedure. *Ultrasound Obstet Gynecol.*;56:388-394. DOI: 10.1002/uog.21882.
5. Zilliox M, Koch A, Favre R, Sananes N. (2019 May). Unusual twin anemia-polycythemia sequence in a dichorionic diamniotic pregnancy. *J Gynecol Obstet Hum Reprod.*;48:359-361. DOI: 10.1016/j.jogoh.2019.02.005. Epub 2019 Feb 19.
6. Jeyaseelan T, Shangaris P, Efthymiou A, Martin L, Story L, Nanda S, Gupta N, Al-Adnani M, Marnerides A, Nicolaides KH, Sankaran S. (2023 Jan 29). Suspected twin anemia polycythemia sequence in a dichorionic, diamniotic twin pregnancy: a case report. *J Med Case Rep.*;17:28. DOI: 10.1186/s13256-023-03766-8.
7. Lee SY, Bae JY, Hong SY. (2022 Apr). Twin anemia polycythemia sequence in a dichorionic diamniotic pregnancy: a case report. *J Yeungnam Med Sci.*;39:150-152. DOI: 10.12701/yujm.2021.01060. Epub 2021 Jul 2.
8. Tollenaar LSA, Prins SA, Beuger S, Slaghekke F, Oepkes D, Lopriore E. (2021). Twin Anemia Polycythemia Sequence in a Dichorionic Twin Pregnancy Leading to Severe Cerebral Injury in the Recipient. *Fetal Diagn Ther.*;48:321-326. DOI: 10.1159/000514408. Epub 2021 Mar 26.
9. Kanagaretnam D, Nayyar R, Zen M. (2021 May 15). Twin anemia polycythemia sequence in dichorionic diamniotic twins: A case report and review of the literature. *Clin Case Rep.*;9:e04184. DOI : 10.1002/ccr3.4184.
10. Lanna M, Faiola S, Casati D, Rustico MA. (2019 Sep). Twin-twin transfusion syndrome in dichorionic twin pregnancy: rare but not impossible. *Ultrasound Obstet Gynecol.*;54:417-418. DOI: 10.1002/uog.20195. Epub 2019 Jul 31.
11. Stenhouse E, Hardwick C, Maharaj S, et al. (2002). Chorionicity determination in twin pregnancies: how accurate are we? *Ultrasound Obstet Gynecol.*; 19: 350–352, DOI: 10.1046/j.1469-0705.2002.00679.x
12. Dziennik A, Preis K, Swiatkowska-Freund M, Rebala K. (2021 Sep 20). Potential of DNA zygosity tests for non-invasive evaluation of risk of complications in twin pregnancies. *Ginekol Pol.*. DOI: 10.5603/GP.a2021.0158.
13. Calomfirescu-Avramescu A, Demetrian M, Grecu G, et al. (2020). Placental fusion in a dichorionic-diamniotic IVF twin pregnancy – case presentation. *Romanian Journal of Medical Practice.; 15*(1): 97–100, DOI:10.37897/rjmp.2020.1.18.
14. Norwitz ER, McNeill G, Kalyan A, et al. (2019). Validation of a single-nucleotide polymorphism-based non-invasive prenatal test in twin gestations: determination of zygosity, individual fetal sex, and fetal aneuploidy. J Clin Med;8:937. https://doi.org/10.3390/jcm8070937.