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# Endoscopic differential criteria for various types of polyps in patients with juvenile polyposis syndrome

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**ABSTRACT** *AIM: to clarify endoscopic features that differentiates juvenile polyps from other types of polyps in patients with juvenile polyposis syndrome.*

*PAIENTS AND METHODS: the retrospective cohort study included 30 patients who met the clinical criteria for juvenile polyposis syndrome in Jan 2012 — Dec 2024. A total of 1026 colorectal neoplasms were analysed comparing endoscopic and morphological images. Endoscopic features that have a significant impact on the determination of juvenile polyps were assessed. The following factors were estimated: size, site, Paris classification criteria, polyp surface, discrepancy with the adenomatous pattern, presence of whitish pits.*

*RESULTS: the most important features are smooth surface, distinguished from adenomatous polyps include discrepancy with the adenomatous surface pattern according to the classifications of Kudo-Sano, as well as the presence of whitish pits of a round, irregular or elongated shape ($p < 0.001$). These criteria allow to determine with a probability of up to 80% that the detected neoplasm will be a juvenile polyp. The endoscopic diagnostic method has a high sensitivity of 93.9% (95% CI: 89.1–97.0) and a negative predictive value of 90.7% (95% CI: 83.5–95.4) in detecting juvenile polyps.*

*CONCLUSION: endoscopic features of juvenile polyps (smooth surface, the discrepancy with the adenomatous surface pattern according to the classifications of Kudo S. and Sano Y., as well as the presence of whitish pits of a round, irregular or elongated shape) were identified.*

**KEYWORDS:** *juvenile polyposis syndrome, juvenile polyp*

**CONFLICT OF INTEREST:** *authors declared no conflict of interest*

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## INTRODUCTION

The incidence of juvenile polyposis syndrome (JPS) is 1:100,000 — 1:160,000 of the population, which is comparable to Peitz-Jaegers' syndrome (1:150,000), but significantly lower than the prevalence of familial adenomatous polyposis (1:10,000) and *MutYH*-associated polyposis (1:20,000 — 1:60,000) [1].

At the same time, the cumulative risk of colorectal cancer in patients with juvenile polyposis is 17–22% at the age of 35 and reaches 68% at the age of 60 [2,3]. Recently, there are no differential endoscopic criteria for juvenile polyps, which may lead to fail detection. One of the features by which hereditary polyposis syndromes are divided into separate categories is precisely the type of neoplasms that occur in endoscopic and subsequent pathomorphological examination: adenomatous, dentate, or hamartomic [4,5]. Classifications that are used for endoscopic characterization of epithelial neoplasms of the large intestine are well

known — Kudo, S. and Sano, Y.'s, NICE, JNET; but it is impossible to characterize hamartomic neoplasms, which include juvenile polyps, using them [6–9]. The difficulty of diagnosing juvenile polyposis syndrome is associated with the possible simultaneous presence of adenomatous and juvenile polyps in the large intestine in more than 50% of patients [10–12]. Due to the fact that an endoscopist is one of the first to meet with patients with hereditary polyposis syndromes, the problem of identifying characteristic endoscopic features is urgent.

## AIM

Aim to identify endoscopic features that make it possible to differentiate juvenile polyps from other types of neoplasms.

## PATIENTS AND METHODS

A retrospective cohort study included 30 patients with JPS from January 2012 to December 2024. Inclusion criterion were the pathogenic variants of the *SMAD4* or *BMPR1A* genes identified.

The following features were evaluated in all patients with identified neoplasms:

1. Pit and vascular surface pattern, identificationof compliance with adenomatous neoplasms using existing classifications (by Kudo S., Sano Y.).
2. Loose or smooth surface of polyps.
3. Macroscopic type of neoplasm growth according to the Paris classification: on a wide base (0-Is type) or on a pedicle (0-Ip type).
4. The size of the neoplasms.
5. The number of identified neoplasms.
6. Polyps site in large intestine: colon and rectum.

At the same time, the colour of the surface was not included in the analysis, since it is a subjective characteristic; its interpretation depends on the technical features of the equipment and the perception of a specialist. The following endoscopic features were specified for juvenile polyps (JPS):

1. Smooth surface (that is, a surface without villous structures).
2. The inability to evaluate the surface using Kudo S. and Sano Y.'s classifications.
3. The presence of whitish rounded, elongated or irregularly shaped pits on the surface (Fig. 1).

With a loose surface (that is, in the presence of villous structures), whitish pits could not be visualized (Fig. 2).

An important condition in the differential diagnosis of juvenile polyposis is the detection of endoscopic signs of active or previous inflammation in the mucous layer of the large intestine (the presence of hyperemia and swelling of the mucous layer, erosions, ulcers, scars, rearrangement or absence of vascular pattern), since juvenile and inflammatory polyps are very similar at the endoscopic and morphological level. The absence of signs of inflammatory changes in the mucous layer surrounding the polyps was interpreted in favour of juvenile polyposis.

Neoplasms were removed endoscopically in 22/30 (73.3%) patients, proctocolectomy was done in 8/30 (26.7%) patients, and subsequently the removed specimen was studied by expert pathologists. An endoscopic picture was compared with the results of morphology of 1,026 neoplasms in 30 patients.

### *Statistical Analysis*

Statistical data processing was performed using SPSS 26.0 software (IBM Corp. Released 2019. IBM SPSS Statistics for Windows, Version 26.0. Armonk, NY: IBM Corp.) and RStudio (R v. 4.3.2 (R Core Team, Vienna, Austria)) using the libraries base, dplyr, gtsummary, rms, MASS, pROC and GenBinomApps. To determine the feasibility of using parametric methods for statistical analysis of quantitative variables, each of the compared totalities was evaluated for its compliance with the law of normal distribution. If the number of subjects was over 50, Kolmogorov-Smirnov's test with Lilyfors's correction was used, and if the number was less than 50, Shapiro-Wilk's test was used. The values of skewness and kurtosis were taken into account, and the histogram data of the sample under study were taken into account. In accordance with the

normal distribution, the quantitative variables were presented as the mean and standard deviation, indicating the 95% confidence interval of the sample ((M ± SD) 95% CI); in the case of a non-normal distribution, they were presented as the median, lower and upper quartiles, minimum and maximum values — Me (Q1; Q3) Min-Max. Qualitative variables were presented as absolute values with a percentage of the total: n/N (%). Student's t-test or Mann-Whitney's U-test were used to compare quantitative variables depending on the normality of the distribution. To compare qualitative variables, Pearson's $\chi^2$ test (with a minimum expected value of 10 or more) or Fischer's precise test (with a minimum expected value of < 10) were used.

The nonparametric Kruskal-Wallis's H-test was used to compare three independent groups based on quantitative criteria. With a value of $p < 0.05$, an adjustment was made for the multiplicity of Bonferroni's comparisons using Dunn's test. To build a mathematical model, the sample (N = 995) was randomly divided into a training and a test sample in a ratio of ~7:3.

Univariate and multivariate logistic regression analyses were performed on the training sample. The association of factors with outcome was assessed by calculating the odds ratio (OR) with 95% CI. In the multivariate model, predictors were selected by step-by-step exclusion. The quality of the model was assessed by McFadden's $R^2$ (the model was considered acceptable at $R^2 > 0.4$). A ROC analysis was performed on the test sample, and the area under the ROC curve, its standard deviation, 95% CI, and significance level were

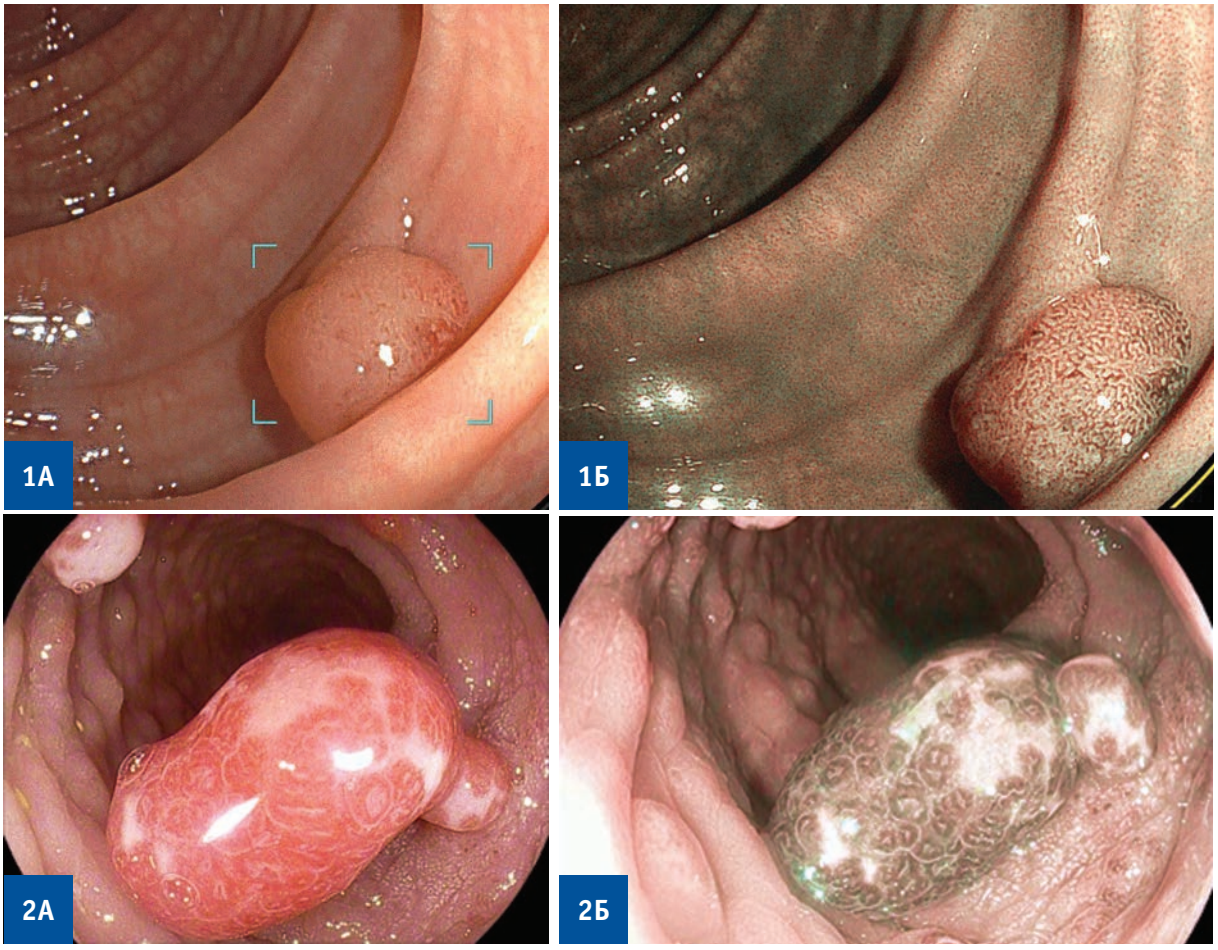


**Figure 1.** *1А, 1Б — endoscopic image of adenomatous neoplasms (in white and in a narrow light spectrum, BLI mode) — dimpled pattern corresponds to type IIIL according to the Kudo S. classification, vascular pattern corresponds to type II according to the Sano Y. classification; 2А, 2Б — endoscopic image of a juvenile polyp (in white and in a narrow light spectrum, mode BLI), whitish pits are indicated by an arrow.*

evaluated. The cut-off point was specified by Yoden's test; sensitivity, specificity, predictive value of a positive result (PVPR) and predictive value of a negative result (PVNR), overall accuracy, as well as their 95% CI (defined using Clopper-Pearson's test) were calculated for it. A nomogram was constructed as a graphical representation of the obtained model to estimate the probability of outcomes. In all calculations, the difference between the features was considered significant at a statistical significance level of $p < 0.05$.

## RESULTS

Based on the comparative analysis of endoscopic and morphological studies, an algorithm for the diagnosis of juvenile polyps has been developed (Fig. 3). According to the highlighted features presented in the algorithm (smooth surface; inability to evaluate the surface using Kudo S. and Sano Y.'s classifications), the presence of whitish rounded, elongated, or irregularly shaped pits on the surface) — 457/590 (77.5%) (95% CI: 73.9–80.8) polyps turned out to be juvenile. In the presence of a loose surface, 37/93 (39.8%) neoplasms were juvenile (95% CI: 29.8–50.5). When characterizing neoplasms according to Kudo S. and Sano Y.'s classifications, 323/343 (94.2%) neoplasms were adenomatous at the morphological level (95% CI: 91.1–96.4).

Based on the endoscopic picture of neoplasms detected in the large intestine, three variants were identified: only juvenile polyps were detected in 14/30 (46.7%) patients, mixed polyposis in 11/30 (36.7%) patients and only adenomatous neoplasms in the large intestine in 5/30 (16.7%) patients. The

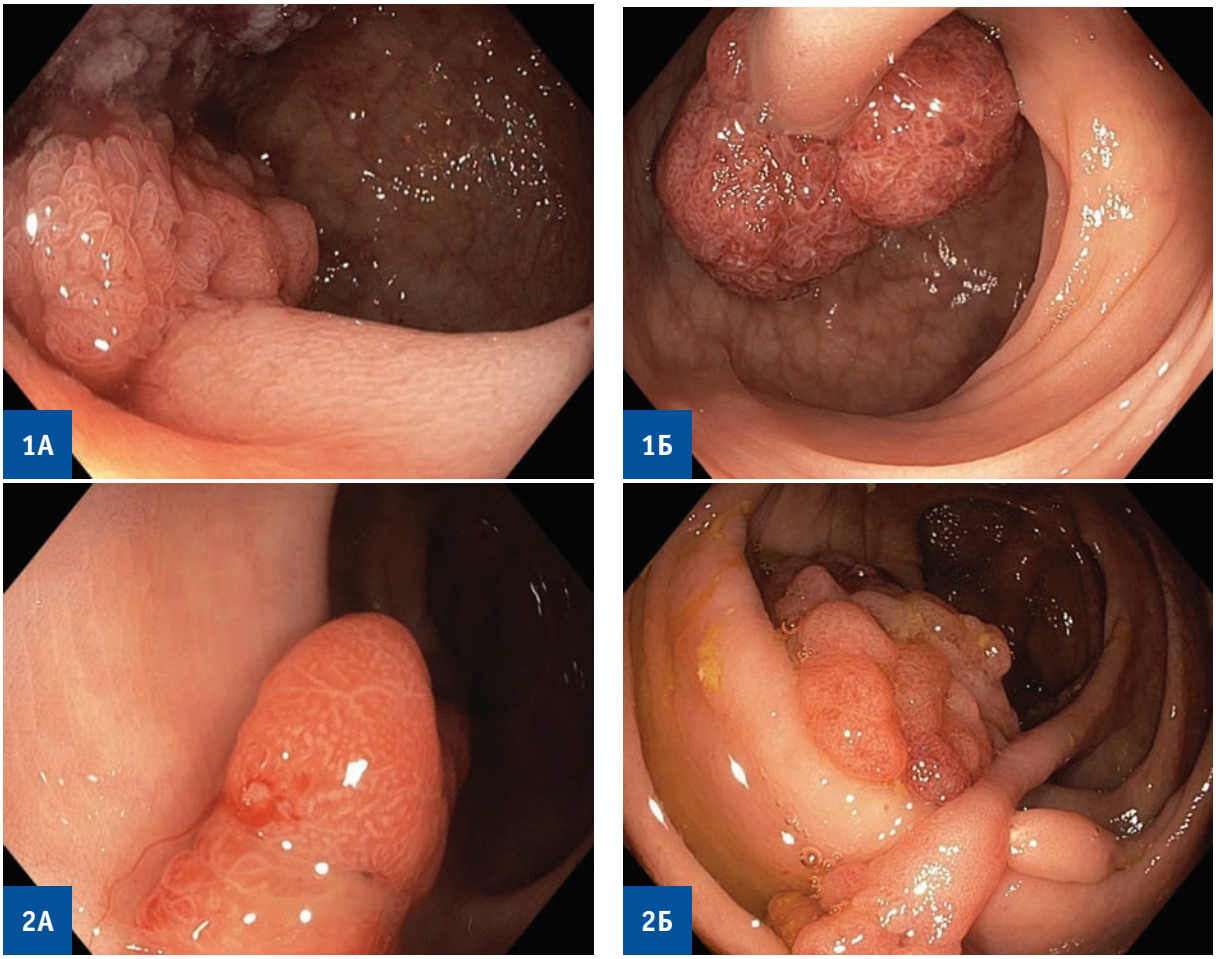


**Figure 2.** *1А, 1Б — adenomatous polyps with a loose surface, with the presence of villous structures, 2А, 2Б — juvenile polyps with a lobed but smooth surface, without the absence of villous structures*

**Table 1.** *Incidence of pathogenic variants in the SMAD4 and BMPR1A genes depending on the endoscopic picture of colorectal neoplasms in patients with JPS*

| | **Only juvenile polyps, *n* (%) N = 11** | **Mixed polyposis, *n* (%) N = 5** | **Only adenomatous polyps, *n* (%) N = 5** |
|---|---|---|---|
| Pathogenic variant of the *SMAD4* gene | 5 (45.5) | 1 (20) | 3 (60) |
| Pathogenic variant of the *BMPR1A* gene | 6 (54.5) | 4 (80) | 2 (40) |

*Note: * Patients with pathogenic variants in the SMAD4 and BMPR1A genes are included*

**Table 2.** *Characteristics of the number and size of polyps in various endoscopic variants of juvenile polyposis syndrome (n = 30*)*

| | **Only juvenile polyps** | **Mixed polyposis** | **Only adenomatous polyps** |
|---|---|---|---|
| The number of neoplasms,<br>Me (Q1;Q3);<br>Min-Max | 15 (3;21)<br>2–47<br>N = 14 | 21 (12.5;32)<br>4–201<br>N = 11 | 4 (2;64)<br>1–200<br>N = 5 |
| Neoplasm size (cm),<br>Me (Q1;Q3);<br>Min-Max | 1.0 (0.8;1.5)<br>0.2–4.0<br>N = 212 | 0.8 (0.5;1.5)<br>0.3–7.0<br>N = 273 | 0.6 (0.4;1.0)<br>0.2–3.0<br>N = 541 |

*Note: * 21 patients with pathogenic variants and 9 patients with wild-type SMAD4 and BMPR1A genes were included*

molecular genetic cause of the disease was identified in 21/30 (70.0%) patients (Table 1). Of the 21 patients with pathogenic variants (mutations) identified: 11/21 (52.4%) patients had only juvenile polyps in the large intestine, 5/21 (23.8%) patients had mixed polyposis, 5/21 (23.8%) patients had adenomatous neoplasms.

In 30 patients, the number of polyps ranged from 1 to 201 polyps with a median of 16.5 (4; 29), the median size was 0.8 (0.5; 1.2) 0.2–7.0 cm (Table 2). The groups did not significantly differ in the number of polyps ($p$ = 0.521), but they differed in size ($p$ < 0.001). When comparing the groups in pairs, it was found that the sizes of neoplasms differ in the groups of adenomatous neoplasms and juvenile polyps, as well as mixed polyposis and

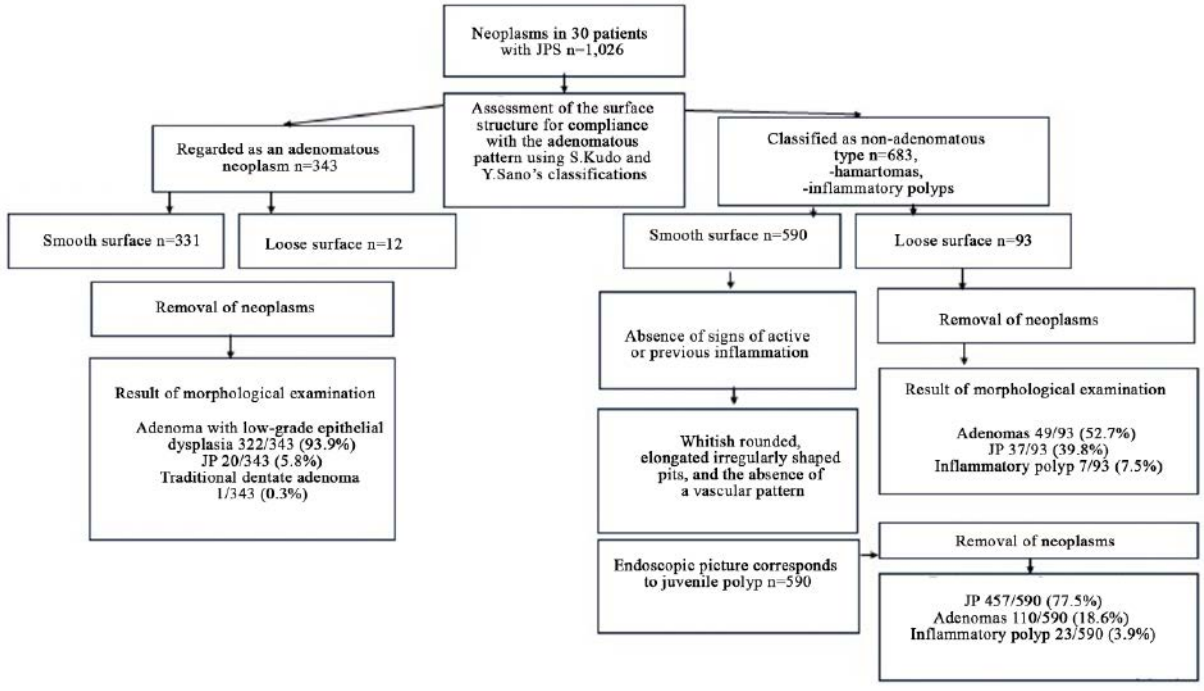


**Figure 3.** *Algorithm for the diagnosis and endoscopic features of juvenile polyps*

**Table 3.** *Endoscopic characteristics of colorectal neoplasms identified in patients with juvenile polyposis syndrome*

| Indicators | Adenomatous polyps N = 343 | Juvenile polyps N = 683 | P |
|---|---|---|---|
| Size (cm)<br>Me (Q1;Q3); Min-Max | 0.6 (0,4,1,0)<br>0.2–4.5 | 0.8 (0,6,1,5)<br>0.2–7.0 | **< 0.001** |
| Localization, *n* (%)<br>Rectum<br>Colon | <br>103 (30)<br>240 (70) | <br>216 (31.6)<br>467 (68.4) | **0.602** |
| Paris Classification, *n* (%)<br>0-Is type (on wide base)<br>0-Ip type (on the pedicle) | <br>275 (80.2)<br>68 (19.8) | <br>350 (51.2)<br>333 (48.8) | **< 0.001** |
| Surface, *n* (%)<br>Smooth<br>Loose | <br>331 (96.5)<br>12 (3.5) | <br>590 (86.4)<br>93 (13.6) | **< 0.001** |
| The presence of whitish pits of rounded, elongated or irregular shape that do not correspond to classifications*, *n* (%) | 0 | 559 (82) | **< 0.001** |
| Compliance with adenomatous structures*, *n* (%) | 343 (100) | 0 | **< 0.001** |
| Kudo S.'s pit pattern, *n* (%)<br>IIIS<br>IIIL<br>IV | <br>249 (72.5)<br>83 (24.2)<br>11 (3.3) | – | **–** |
| Vascular pattern according to Y.Sano's classification, *n* (%)<br>II | <br>343 (100) | – | **–** |
| Results of the pathomorphological study, n/N (%)<br>Adenomas<br>JP<br>Traditional dentate adenoma<br>Inflammatory and hyperplastic polyps | <br>322/343 (93.9)<br>20/343 (5.8)<br>1/343 (0.3)<br>– | <br>162/683 (24.3)<br>492/683 (72.8)<br>–<br>29/683 (2.9) | **–** |

*Note: * Assessment of the pit pattern using Kudo S.'s classification and vascular pattern using Sano Y.'s classification*

juvenile polyps ($p < 0.001$). When comparing adenomatous and juvenile neoplasms, criteria such as size, site, macroscopic appearance and surface have no differential diagnostic significance, since the difference in indicators is minimal and any of these features can occurred in each of the groups. The most important diagnostic feature of all the characteristics is the ability to assess the surface of neoplasms according to Kudo S. and Sano Y.'s classifications. Unlike juvenile polyps, the surface of all adenomatous neoplasms 343/343 (100%) could be characterized using these classifications. At the same time, whitish pits of rounded, elongated or irregular shape were revealed in 559/590 (94.8%) juvenile polyps with a smooth surface (Table 3).

The discrepancy between the results of endoscopic diagnosis and the morphological picture was revealed in 191/683 (28%) neoplasms, which according to endoscopic criteria were initially interpreted as juvenile polyps; their characteristics are shown in Table 4. The size of these neoplasms was 0.2–7.0 cm, with a median of 1.2 (0.6; 2) cm, which did not differ from other neoplasms. According to morphology, 160/191 (83.8%) neoplasms had the structure of adenomas with low-grade epithelial dysplasia, 1/191 (0.5%) neoplasm had adenomas with high-grade epithelial dysplasia, 1/191 (0.5%) neoplasm had adenocarcinomas, the other neoplasms were inflammatory and hyperplastic polyps 29/191 (15.2%).

The features we identified as characteristic of juvenile polyps are: size, site, Paris classification (on a wide base or on a pedicle), smooth or loose surface, compliance with the adenomatous pattern according to Kudo, S. and Sano, Y.'s classifications, the presence of whitish pits, were included in the univariate and multivariate analyses with

**Table 4.** *Characteristics of polyps that were endoscopically regarded as juvenile, but were not confirmed by pathomorphology (n = 191)*

| Indicators | Polyps N = 191 |
|---|---|
| Size (cm)<br>Me (Q1;Q3); Min-Max | 1.2 (0,6,2)<br>0.2–7.0 |
| Localization, *n* (%)<br>Colon<br>Rectum | <br>103 (54)<br>88 (46) |
| The surface of the polyps, *n* (%)<br>Smooth<br>Loose | <br>104 (54.5)<br>87 (45.5) |
| Results of the pathomorphological study, *n* (%)<br>Adenoma<br>Low-grade<br>High-grade<br>Adenocarcinoma<br>Inflammatory polyp<br>Hyperplastic polyp | <br><br>160 (83.8)<br>1 (0.5)<br>1 (0.5)<br>25 (13.1)<br>4 (2.1) |

the compilation of a nomogram and the construction of a ROC curve. At the same time, the calculation of the identified endoscopic features was performed based on the specification of the type of neoplasms based on morphology. In the training sample (N = 686), juvenile polyps and adenomatous polyps were compared according to all of the above characteristics (Table 5).

329/350 (94.0%) juvenile polyps had a smooth surface more often than adenomatous polyps — 295/336 (87.8%) ($p = 0.005$).

Whitish pits were detected in 334/350 (95.4%) juvenile polyps, which is significantly more common than in adenomatous polyps — 64/336 (19.0%) ($p < 0.001$). Adenomatous polyps — 225/336 (67.0%) had an adenomatous surface pattern more often than juvenile polyps: 10/350 (2.9%) ($p < 0.001$).

A univariate analysis was performed to find endoscopic characteristics capable of predicting the morphological structure of the neoplasm (Table 6). Four significant variables were identified: the size of the neoplasm, smooth surface, correspondence of the surface pattern to adenomatous and the presence of whitish pits. With small neoplasm sizes, the chance of its identification as a juvenile polyp rather than an adenomatous one is 1.3 times greater (OR = 0.77; 95% CI: 0.61–0.97). When matching the adenomatous surface pattern, the chance of detecting a juvenile polyp during morphological examination is 100 times less than that of an adenomatous one (OR = 0.01; 95% CI: 0.01–0.03). When whitish pits are detected, the probability that the detected neoplasm will turn out to be a juvenile polyp rather than an adenomatous one is 89 times greater (OR = 88.7; 95% CI: 51.6–162.0). In the presence of a smooth surface, the chance that the detected neoplasm will turn out to be juvenile rather than adenomatous is 2 times greater (OR = 2.18; 95% CI: 1.27–3.83).

**Table 5.** *Descriptive statistics of endoscopic characteristics of juvenile and adenomatous polyps taking into account morphology (training sample)*

| Indicators | Juvenile polyps N = 350 | Adenomatous polyps N = 336 | P |
|---|---|---|---|
| Size, cm<br>Me (Q1;Q3); Min-Max | 0.8 (0.5; 1.2)<br>0.3–3.0 | 0.8 (0.5; 1.5)<br>0.2–7.0 | 0.8 |
| Localization<br>Colon<br>Rectum | <br>252 (72.0%)<br>98 (28.0%) | <br>237 (70.5%)<br>99 (29.5%) | 0.7 |
| Paris classification<br>On the pedicle(0-Ip)<br>On the wide base (0-Is) | <br>141 (40.3%)<br>209 (59.7%) | <br>118 (35.1%)<br>218 (64.9%) | 0.2 |
| Polyps face<br>Smooth<br>Loose | <br>329 (94.0%)<br>21 (6.0%) | <br>295 (87.8%)<br>41 (12.2%) | **0.005** |
| The surface pattern corresponds to the adenomatous | 10 (2.9%) | 225 (67.0%) | **< 0.001** |
| Whitish pits | 334 (95.4%) | 64 (19.0%) | **< 0.001** |

**Table 6 .***Univariate analysis of the predictive ability of endoscopic criteria in identifying the morphological structure of polyps (training sample)*

| Indicators | OR (95% CI) | P |
|---|---|---|
| Size of the neoplasm (cm) | 0.77 (0.61–0.97) | **0.028** |
| Localization in the colon | 1.07 (0.77–1.50) | 0.7 |
| Neoplasm on a wide base (0-Is as per Paris Classification) | 0.80 (0.59–1.09) | 0.2 |
| Smooth surface of the neoplasm | 2.18 (1.27–3.83) | **0.005** |
| The surface pattern corresponds to the adenomatous | 0.01 (0.01–0.03) | **< 0.001** |
| Whitish pits | 88.7 (51.6–162.0) | **< 0.001** |

**Table 7.** *Multivariate analysis of the predictive value of endoscopic criteria in identifying juvenile polyps confirmed by morphology*

| Variable | β (SD) | OR (95% CI) | P |
|---|---|---|---|
| The constant of the regression equation | –2.37 (0.49) | 0.09 (0.03–0.23) | **< 0.001** |
| Neoplasm on a wide base (0-Is as per Paris Classification) | 0.45 (0.27) | 1.56 (0.93–2.64) | 0.094 |
| Smooth surface of the neoplasm | 0.48 (0.43) | 1.62 (0.68–3.67) | 0.3 |
| The surface pattern corresponds to the adenomatous | –1.59 (0.59) | 0.20 (0.07–0.68) | **0.007** |
| Whitish pits | 3.34 (0.48) | 28.32 (11.81–80.06) | **< 0.001** |

Other factors do not significantly affect the predictive ability of the morphology.

As a result of the step-by-step selection of parameters, 3 features were included in the multivariate model: neoplasms on a wide base, the correspondence of the surface pattern to adenomatous and the presence of whitish pits; however, taking into account the importance of assessing the surface of the polyp, this feature was forcibly included (Table 7).

It was found that the detection of whitish pits (OR = 28.32; 95% CI: 11.81–80.06) and inconsistency with the adenomatous pattern (OR = 0.20; 95% CI: 0.07–0.68) are independent factors that significantly increase the chance that the detected neoplasm is a juvenile polyp. McFadden's $R^2 = 0.51$,

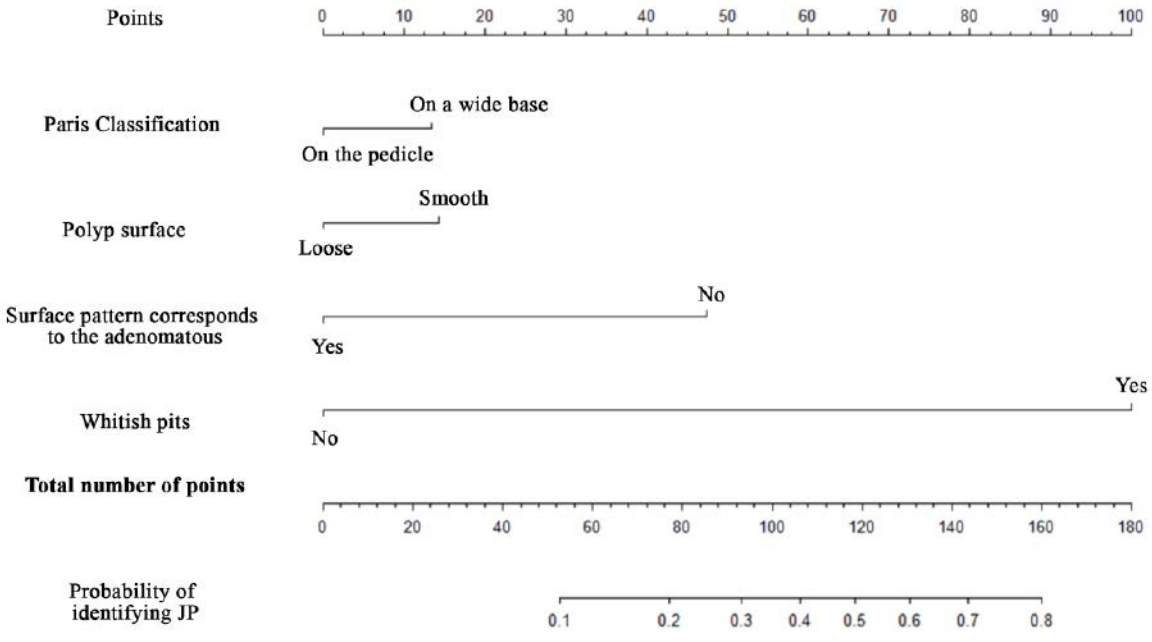


**Figure 4.** *Nomogram for assessing the probability of detecting juvenile polyps based on endoscopic criteria*

**Table 8.** *Classification matrix for evaluating the diagnostic effectiveness of determining juvenile polyps based on the results of the obtained mathematical model (tested on a test sample)*

| | JP (based on the results of morphological examination) | Adenoma (based on the results of morphological examination) | Total number |
|---|---|---|---|
| JP (model) | 151 | 32 | 183 |
| Adenoma (model) | 13 | 113 | 126 |
| Total | 164 | 145 | 309 |

**Table 9.** *Classification matrix for assessing the diagnostic effectiveness of identifying juvenile polyps based on endoscopy (test sample)*

| | JP (based on the results of morphological examination) | Adenoma (based on the results of morphological examination) | Total number |
|---|---|---|---|
| JP (based on the results of endoscopic examination) | 154 | 48 | 202 |
| Adenoma (based on the results of endoscopic examination) | 10 | 97 | 107 |
| Total | 164 | 145 | 309 |

which indicates an acceptable correspondence of the regression model to real data.

A nomogram was constructed as a graphical representation of the obtained model for estimating the probability that a neoplasm visualized endoscopically would turn out to be a juvenile polyp according to morphology (Fig. 4). The nomogram is presented as a set of scales, each of which corresponds to a certain variable — size, Paris Classification, as well as the surface of the polyp, compliance with the adenomatous surface pattern, the presence of whitish pits. The initial parameter is given certain points, depending on the magnitude of its value, then the sum of each parameter of the points is calculated and the percentage probability that the neoplasm is a juvenile polyp is defined.

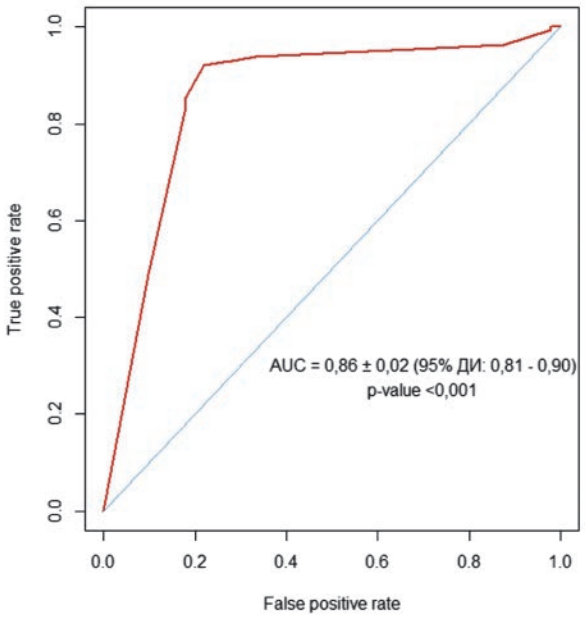


**Figure 5.** *ROC curve of the obtained model based on the test sample*

A ROC analysis was performed on the test sample (N = 309) and the ROC curve was constructed (Fig. 5). The function value of 0.43 was chosen as the cut-off point by Yoden's test.

The area under the ROC curve is AUC = 0.86 ± 0.02 (95% CI: 0.81–0.90), $p < 0.001$, which indicates that the endoscopy has a good diagnostic ability in detecting juvenile large intestine polyps.

When checking the diagnostic effectiveness of identifying juvenile polyps based on the results of the mathematical model obtained, sensitivity was 92.1% (95% CI: 86.8 — 95.7), specificity was 77.9% (95% CI: 70.3 — 84.4), PVPR was 82.5% (95% CI: 76.2 — 87.7), PVNR was 89.7% (95% CI: 83.0 — 94.4) and overall accuracy — 85.4% (95% CI: 81.0 — 89.2) (Table 8).

When checking the diagnostic effectiveness of identifying juvenile polyps based on the results of endoscopic examination in the test sample, sensitivity was 93.9% (95% CI: 89.1–97.0), specificity was 66.9% (95% CI: 58.6–74.5), PVPR was 76.2% (95% CI: 69.8–81.9), PVNR was 90.7% (95% CI:

83.5–95.4) and overall accuracy — 81.2% (95% CI: 76.4–85.4), respectively (Table 9). When comparing the obtained results of the diagnostic characteristics of the mathematical model and the endoscopic examination in comparison with the morphology, significant differences were revealed only in specificity ($p$ = 0.036), with a large value for the mathematical model (coincidence intervals intersected). Despite the fact that the exact values of sensitivity and PVNR were slightly higher in the endoscopic examination, and PVPR and overall accuracy were lower than in the mathematical model, there were no statistically significant differences in these indicators
($p_{sensitivity}$ = 0.5; $p_{PVNR}$ = 0.8; $p_{PVPR}$ = 0.13 and $p_{overall\ accuracy}$ = 0.16).

## DISCUSSION

According to the literature, 50% of patients with JPS are characterized by the presence of mixed polyposis [14]. There are also separate series of cases when only adenomatous neoplasms are detected in patients in the large intestine [15]. According to our data, 46.7% of patients with juvenile polyposis have only juvenile polyps in the large intestine, 36.7% of patients have mixed polyposis, and 16.7% of patients have adenomatous neoplasms.

It should be emphasized that in patients with adenomatous polyps, the diagnosis of juvenile polyposis syndrome was verified after molecular genetic study, excluding pathogenic variants in the *APC* gene, and performing full-exome sequencing: 3 out of 5 patients had a pathogenic variant of the *SMAD4* gene, and 2 out of 5 had a pathogenic variant of the *BMPR1A* gene. In patients with 20 or more epithelial neoplasms of the large intestine, it is advisable to conduct a molecular genetic study to identify pathogenic variants of the *APC* and *MutYH* genes, and in their absence, advanced genetic search (using high-throughput sequencing) is necessary [16].

Recently, there are no developed classifications and differential diagnostic criteria for the endoscopic assessment of juvenile polyps. According to the literature, the features of juvenile polyps are: hyperemia of the surface, the presence of erosion, caps of white mucus. When assessing the surface structure, open pits with inflammatory changes and a low density of the pit pattern are revealed [11,12]. This description may also be characteristic of inflammatory polyps. A number of authors indicate that it is necessary to make a differential diagnosis between juvenile and inflammatory polyps [12,13,17,18]. Morphologically, juvenile polyps are also difficult to differentiate from inflammatory ones [19]. It is extremely important to emphasize that based on our research; the absence of signs of active or previous inflammation in the mucous layer surrounding the neoplasm (absence of erosions, ulcers, scars, hyperemia and swelling of the mucous layer, vascular pattern rearrangement) allows to exclude inflammatory polyps and indicates in favor of juvenile ones. In this study, for the first time, the features that characterize juvenile polyps and have a high predictive value were identified: a smooth surface, the inability to evaluate the surface using Kudo S. and Sano Y.'s classifications, inconsistency with the adenomatous pattern; the presence of whitish rounded, elongated or irregularly shaped pits on the surface. If these features are present and signs of active or previous inflammation in the surrounding mucosa are excluded, there is a probability of up to 80% that the detected neoplasm will be a juvenile polyp.

## CONCLUSION

Endoscopic features were identified (smooth surface, non-compliance with the adenomatous pattern according to Kudo S. and Sano Y.'s classifications, as well as the presence of whitish pits of rounded, irregular or elongated shape), which make it possible to verify juvenile polyps with high probability.

**AUTHORS CONTRIBUTION**

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