Efficacy, risk factors and complications of endoscopic polypectomy: Ten year experience at a single center

Pierluigi Consolo, Carmelo Luigiano, Giuseppe Strangio, Maria Grazia Scaffidi, Giuseppa Giacobbe, Giovanna Di Giuseppe, Agata Zirilli, Luigi Familiari

AIM: To examine the efficacy and complications of colonoscopic resection of colorectal polypoid lesions.

METHODS: We retrospectively reviewed 1354 polypectomies performed on 1038 patients over a ten-year period. One hundred and sixty of these were performed for large polyps, those measuring ≥ 20 mm. Size, shape, location, histology, the technique of polypectomy used, complications, drugs assumption and associated intestinal or extra intestinal diseases were analyzed. For statistical analysis, the Pearson χ² test, NPC test and a Binary Logistic Regression were used.

RESULTS: The mean patient age was 65.9 ± 12.4 years, with 671 men and 367 women. The mean size of polyps removed was 9.45 ± 9.56 mm while the size of large polyps was 31.5 ± 10.8 mm. There were 388 pedunculated and 966 sessile polyps and the most common location was the sigmoid colon (41.3%). The most frequent histology was tubular adenoma (55.9%) so that, in these conditions, complications should be an uncommon event.

CONCLUSION: The endoscopic resection is a simple and safe procedure for removing colon rectal neoplastic lesions and should be considered the treatment of choice for large colorectal polyps. The polyp size is an important risk factor for malignancy and for bleeding.

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Key words: Colonoscopy; Polypectomy; Large polyps; Colorectal neoplastic lesions; Endoscopic resection

INTRODUCTION

The colonoscopic polypectomy was introduced by Wolf and Shinya in the early 1970s and has become the most common therapeutic procedure performed within endoscopic units[1]. Colonoscopic polypectomy is the first approach and the standard treatment for colon rectal polyps and, therefore, a prevention of colorectal cancer. It is a safe technique when performed by expert hands using a cautious technique and equipment that works properly; so that, in these conditions, complications should be an uncommon event.

Some factors can increase the rate of complications such as the type (pedunculated or sessile) and size of the polyp, its location and other factors regarding the comorbidity of the patient (coagulation disorders or drug assumption) and the technique used. The most common complications after polypectomy are bleeding (from 0.3% to 6.1%) and pain due either to excessive gas accumulation or to parietal damage and perforation after current...
A. The alternative to resected using two techniques, en bloc and piecemeal. With the application of endoloop.出血, except for the polypectomy, as a prophylactic measure to prevent the injection into the base of the stalk was not performed, before below the polyp head. In all pedunculated polyps injection endoloop. and the inject, lift, and cut for broad-based lesions) and mucosectomy (en bloc, piecemeal, the inject and cut cold snare in smaller lesions and larger protruding lesions), were created: direct snare (hot or cold biopsy and hot or endoscopic snare used during the polypectomy procedure Erbe APC 300 were also used. The sclerosis needle and one Pentax EC3830FK videocolonoscopes. An colonoscopy. The colonoscopy was performed according polyethylene glycol electrolytic lavage solution 18 h before the investigation and the assumption of 4000 mL of a polyethylene glycol electrolytic lavage solution 18 h before colonoscopy. The colonoscopy was performed according to standard procedure using two Olympus CF-100 HI and one Pentax EC3830FK videocolonoscopes. An electrocautery Erbe ICC 200 and argon plasma coagulation Erbe APC 300 were also used. The sclerosis needle and endoscopic snare used during the polypectomy procedure were the standard models. All procedures were performed by two expert endoscopists.

RESULTS
The demographic and clinical data of the patients studied and the characteristics of polyps according to size are illustrated in Table 1 and Table 2. Among 1354 endoscopic polypectomies, 907 were lesions less than 10 mm of diameter, 287 between 11 and 19 mm, and 160 more than 20 mm; the size of total polyps was 9.45 ± 9.56 (range 1-100) while the size of large polyps was 31.5 ± 10.8. Macroscopically sessile shapes were prevalent (966/1354 -71.3%) and the pedunculated ones were 388 (28.7%). The most frequent location of the polyps was the sigmoid colon (559/1354 -41.3%). The most frequent location of large polyps was the sigmoid colon (65/160 -40.7%). The most commonly used technique was direct endoscopic snare resection in 1294 polypectomies (95.6%) as well as in the group of large polyps 132/160 (82.5%). The most frequent histological type among all the polyps resected was tubular adenoma, 756/1354 -55.9%, while, for the large polyps, it was the villous type (92/160 -57.5%). Of the removed polyps, 1078 were adenomas with low grade dysplasia (79.6%), 123 with high grade dysplasia (9.1%) and 28 (2.1%) were adenomas containing

All resected material was retrieved for histological examination. Post-polypectomy bleeding was defined as procedural if it occurred during polypectomy, immediate if it occurred within 24 h of polypectomy, and delayed if it occurred more than 24 h after the procedure. Bleeding was treated by injection therapy, with dilute adrenalin at a concentration of 1:10000 with or without 1% polidocanol, hemoclips and thermal coagulation using argon plasma. The variables evaluated in the study were: polyp size, polyp shape, their location along the colon, complications (bleeding and perforation), histology, technique of polypectomy applied, drugs assumption and associated intestinal or extra intestinal diseases.

Continuous data are described by mean and standard deviation or median and range, according to distribution. Categorical data are presented as numbers and percentages. The Pearson $\chi^2$ test with Brandt-Snedecor and Kimball's formula was used to assess the association between categorical variables while to individualize the correlation between categorical variables and some numerical variables a biserial correlation coefficient was used. Differences between the groups were evaluated using the non parametric combination NPC Test, based on permutation tests. A $P$-value < 0.05 was considered statistically significant. The estimation of a Binary Logistic Regression model allowed for the individualization of the variables which were tied on the bleeding. In this context, the estimation of Log-Likelihood test and G test allows for the obtainment of the measure of goodness-of-fit.

Software used included SPPS, Windows 11.0 (2001) for Pearson $\chi^2$ test and biserial correlation, Microsoft Excel (2002) for the Brandt-Snedecor method and Kimball's formula, Methodologica S.R.L. (2001) for nonparametric analysis NPC test and Minitab Release 13.31, Copyright © 2000 Minitab Inc. for Binary Logistic Regression.

MATERIALS AND METHODS
From January, 1996 to May, 2006, 1038 patients underwent colonoscopy for the removal of 1354 polypoid lesions. Of these polypectomies, 160 (11.8%) were performed on large polyps, those measuring 20 mm or more. The patients were prepared for colonoscopy following standard protocol, following a fiber and residue free diet within 72 h before the investigation and the assumption of 4000 mL of a polypectomy applied, drugs assumption and associated complications and risk factors.

Pedunculated polyps were transected at the stalk just below the polyp head. In all pedunculated polyps injection into the base of the stalk was not performed, before polypectomy, as a prophylactic measure to prevent the bleeding, except for the cases of pedunculated polyps with a very big stalk where bleeding prophylaxis was performed with the application of endoloop. Sessile polyps were resected using two techniques, en bloc and piecemeal. The most frequent histological type among all the polyps resected was tubular adenoma, 756/1354 -55.9%, while, for the large polyps, it was the villous type (92/160 -57.5%). Of the removed polyps, 1078 were adenomas with low grade dysplasia (79.6%), 123 with high grade dysplasia (9.1%) and 28 (2.1%) were adenomas containing
an area of invasive carcinoma and of these 20 were large polyps. The estimation of biserial correlation coefficient allows us that the cancer and polyp size are correlated ($P < 0.0001$), but there wasn't a significant correlation

Table 1 Demographic and clinical data of the populations studied

|                          | Total | Group 1 | Group 2 | Group 3 | Group 4 |
|--------------------------|-------|---------|---------|---------|---------|
| Number of patients       | 1038  | 675     | 211     | 121     | 31      |
| Age                      | 65.9 ± 12.4 | 65.1 ± 12.9 | 67.1 ± 11.9 | 68.1 ± 10.3 | 71.9 ± 9.9 |
| Sex                      | 671/367 | 448/227 | 133/78  | 73/48   | 17/14   |
| Drugs assumption          |       |         |         |         |         |
| Aspirin or anticoagulant  | 22 (2.1%) | 12 (1.7%) | 6 (2.8%) | 4 (3.3%) |         |
| Associated extra intestinal diseases |       |         |         |         |         |
| Cardiac diseases          | 70 (6.7%) | 47 (6.96%) | 13 (6.16%) | 8 (6.6%) |         |
| Diabetes Mellitus         | 8 (0.7%) | 8 (1.18%) |         |         |         |
| Chronic Renal Failure     | 11 (1.05%) | 4 (0.6%) | 4 (1.89%) | 5 (4.1%) | 1 (3.22%) |
| Neoplasms                 | 32 (3.08%) | 18 (2.6%) | 8 (3.79%) | 5 (4.1%) | 1 (3.22%) |
| Liver diseases            | 34 (3.3%) | 26 (3.85%) | 5 (2.36%) | 3 (2.47%) |         |
| Endocrinological diseases | 1 (0.09%) | 1 (0.14%) |         |         |         |
| Associated intestinal diseases |       |         |         |         |         |
| Diverticula               | 262 (25.2%) | 188 (27.8%) | 51 (24.1%) | 17 (14.04%) | 6 (19.3%) |
| CRC                      | 112 (10.8%) | 60 (8.88%) | 36 (17.06%) | 16 (13.2%) |         |
| IBD                      | 31 (2.9%) | 22 (3.25%) | 8 (3.79%) | 1 (0.8%) |         |
| Ischemic colitis          | 8 (0.7%) | 7 (1.03%) |         |         | 1 (0.8%) |
| Emorroidi                 | 39 (3.75%) | 27 (4%) | 9 (4.26%) | 3 (2.47%) |         |
| Angiodysplasia            | 13 (1.25%) | 12 (1.77%) | 1 (0.47%) |         |         |

Table 2 Characteristics of polyps resected according to size

|                          | Total | Group 1 | Group 2 | Group 3 | Group 4 |
|--------------------------|-------|---------|---------|---------|---------|
| Number of polypectomy    | 1354  | 907     | 287     | 129     | 31      |
| Size (mm)                | 9.45 ± 9.56 | 4.8 ± 2.18 | 11.8 ± 2.6 | 27.7 ± 5.8 | 46.8 ± 13.02 |
| Location                 |       |         |         |         |         |
| Rectal                   | 247 (18.3%) | 146 (16.1%) | 54 (18.8%) | 33 (2.6%) | 14(45.4%) |
| Left colon               | 184 (13.6%) | 126 (13.9%) | 44 (15.3%) | 13 (10.1%) | 1 (3.2%) |
| Spleenic flexure         | 24 (1.8%) | 14 (1.6%) | 8 (2.8%) | 1 (0.8%) | 1 (3.2%) |
| Transverse               | 94 (6.9%) | 69 (7.6%) | 17 (5.9%) | 6 (4.7%) | 2 (6.4%) |
| Hepatic flexure          | 64 (4.7%) | 45 (4.9%) | 12 (4.2%) | 3 (2.3%) | 4 (12.8%) |
| Right colon              | 129 (9.5%) | 95 (10.5%) | 23 (8%) | 9 (6.9%) | 2 (6.4%) |
| Caecum                   | 53 (3.9%) | 37 (4.1%) | 10 (3.5%) | 5 (3.9%) | 1 (3.2%) |
| Histology                |       |         |         |         |         |
| Tubular adenoma          | 756 (55.9%) | 596 (65.8%) | 138 (48.1%) | 19 (14.7%) | 3 (9.7%) |
| Villous adenoma          | 245 (17.9%) | 103 (11.3%) | 48 (16.7%) | 66 (51.2%) | 26 (83.9%) |
| Tubulovillous adenoma    | 315 (23.3%) | 174 (19.2%) | 97 (33.8%) | 42 (32.6%) | 2 (6.4%) |
| Dysplasia                |       |         |         |         |         |
| No                       | 125 (9.2%) | 117 (12.9%) | 6 (2.1%) | 2 (1.5%) |         |
| LGD                      | 1078 (79.6%) | 769 (84.8%) | 245 (85.4%) | 57 (44.2%) | 7 (22.6%) |
| HGD                      | 123 (9.1%) | 77 (11.1%) | 32 (11.1%) | 51 (39.5%) | 23 (74.2%) |
| Invasive cancer          | 26 (2.1%) | 4 (0.4%) | 4 (1.4%) | 19 (14.8%) | 1 (3.2%) |
| Technique of polypectomy |       |         |         |         |         |
| Direct snare             | 1294 (95.6%) | 907 (100%) | 255 (88.9%) | 108 (83.7%) | 24 (77.4%) |
| Mucoseotomy              | 56 (4.1%) | 30 (10.4%) | 19 (14.8%) | 7 (22.6%) |         |
| Endoloop                 | 4 (0.3%) | 2 (0.7%) | 2 (1.5%) |         |         |
| Complication             |       |         |         |         |         |
| Bleeding                 | 17 (1.3%) | 4 (0.4%) | 3 (1.05%) | 7 (5.4%) | 3 (9.7%) |
| Perforation              | 1 (0.07%) | 1 (0.35%) |         |         |         |
| Technique of hemostasis  |       |         |         |         |         |
| Injection                | 13 (76.5%) | 4 (100%) | 2 (66.7%) | 6 (85.7%) | 1 (33.3%) |
| Clips                    | 3 (17.6%) | 1 (33.3%) |         | 2 (66.7%) |         |
| APC                      | 1 (5.9%) |         |         |         | 1 (14.3%) |
between cancer and age ($P = 0.464$). To evaluate the association between malignancy and sex, histology, location and shape, we applied a $\chi^2$ test, where it showed significant results for the association with shape ($P < 0.0001$), in particular sessile sex ($P < 0.0001$), and the association between cancer and location ($P = 0.719$). Cancer with histology ($P = 0.819$) was not statistically significant.

The endoloop was used as a prophylactic measure to prevent postpolypectomy bleeding in four cases (0.3%) for pedunculated polyps. The “endoloop” prevented bleeding from the stalk in all cases. Procedural bleeding occurred in 1.3 % (17/1354) of all polyps (11 sessile and 6 pedunculated). In large polyps the bleeding occurred in 10/160 (6.3%). Bleeding was always managed by endoscopic means with the application of hemoclips in 3 cases, adrenaline injection in 13 cases and APC in 1 case. There was no acute or late bleeding. There was no need for blood transfusion.

With the application of the Pearson $\chi^2$ test, the association between the studied variables was shown to be statistically significant: bleeding and extra intestinal diseases ($P < 0.0001$) and the histology ($P = 0.016$). In particular, between bleeding and cardiac diseases ($P = 0.034$) and tubular adenoma ($P = 0.016$). The Pearson $\chi^2$ test was also applied in the sub-groups for evaluation of the association between the bleeding and the studied variables and the $P$-values are illustrated in Table 3.

Statistical analysis performed by NPC test showed a highly significant difference between the four groups examined in relation to bleeding; the $P$-values of the analysis are shown in Table 4.

The results of the Binary Logistic Regression (Table 5) allowed confirmation that the associated extra intestinal diseases, histology and the size of the polyps are statistically significant and are linked to the occurrence of bleeding. For the aforesaid model the Log-Likelihood test assumes a value of -62.662, the G test is equal to 57.276 with 9 degrees of freedom and the $P$-value is 0.000; for this reason we can affirm that the chosen model is adequate to examine the data.

Perforation occurred in one patient (0.07%) after polypectomy of a malignant sessile polyp in the sigmoid colon, but in this lesion of 15 mm there was no suspicion of malignancy. This patient died after surgery repair of perforation from respiratory failure.

### DISCUSSION

In the past two decades the technique of endoscopic polypectomy or mucosal resection has been significantly improved and is the most common therapeutic procedure performed in the endoscopic unit. A particular challenge is the endoscopic treatment of large polyp because the procedure is difficult and reserved for experts since complications rates are very high. In this study, we described a series of 1354 endoscopic resections of colon rectal polyps performed in our endoscopic units between January, 1996 and May, 2006. The gender and age distribution of patients is similar to that described above in other studies regarding the treatment of colorectal polyps.[1-19]

From the literature, it emerges that over 80% of polyps resected during colonoscopy are small polyps less than 10 mm in diameter[26] while in our study 67% were 10 mm in diameter. In fact, during a ten-year period we found 11.8% of excised polyps to be 20 mm or more in size out of 1354 total polypectomies. These data illustrate an average of 16 large polyps removed annually. Other authors reported averages of between 8 and 21 large polyps removed annually.[1-19]. In the present study, all patients with large colorectal polyps were treated endoscopically and in all cases the complete removal of all pedunculated and sessile polyps was possible.

Several previous publications reported a correlation between malignancy and age of patients, polyp shape, histology, location and higher rates in large polyps up to 50%.[6,25-31]. In the present study, 28 polyps were found to be adenomas containing an area of carcinoma (2.1%) and of these, 20 (12.5%) were in the group of large polyps; however, none of these polyps showed neither vascular or lymphatic invasion.

Statistical analysis, performed by bivariate correlation coefficient and the $\chi^2$ test, showed a correlation between cancer, polyp size ($P < 0.0001$), sex ($P < 0.0001$) and sessile shape ($P < 0.0001$). In accordance with previous publications, we documented a correlation with size, sessile shape and sex. Moreover, our data suggest that invasive carcinoma can appear with an equal probability, both in a
The endoscopic polypectomy is a procedure of choice for non-surgical treatment of large colorectal polyps. It is safe and effective and should be considered the treatment of choice also for large colorectal polyps. The endoscopic polypectomy, performed by an expert hand, is safe and effective and should be considered the treatment of choice also for large colorectal polyps.

Polyp size has been identified as an important risk factor for both malignancy and bleeding. Haemorrhage was the most frequent complication even if it remains questionable whether the bleeding should be considered a complication when it occurs during the procedure and is effectively and immediately controlled by endoscopic means. Similarly, in fact, if during a surgical procedure an artery is sectioned and bleeding, this event is not questioned whether the bleeding should be considered a complication when it occurs during the procedure and is effectively and immediately controlled by endoscopic means.

The incidence of perforation during therapeutic colonoscopies has been reported to range from 0.08%-2.2% [13-19]. The reported incidence of perforation during polypectomy of “normal-sized” polyps ranges from 0.3%-0.5% [34], while the incidence of injury to the colon wall (transmural burn, microperforation, or free perforation) in large polypectomies is 0 to 1.3% (Table 6) [3-19].

In our study, no perforation was reported in the group of large polyps while the only late perforation (0.07%) occurred, after polypectomy, in a small (15 mm) malignant sessile polyp located in the sigmoid colon and without endoscopic sign of suspected malignancy. During the removal of this polyp, a procedural bleeding occurred, which was immediately managed by application of two hemoclips and the patients’ hospitalization. Twenty four hours after the polypectomy, the patient developed lower left quadrant pain, tenderness and radiographic evidence of free air in the peritoneal cavity. The patient underwent surgery for a small (1-2 mm) perforation of the sigma. Unexpectedly, this patient died four days after surgery from respiratory failure secondary to a pleural mesothelioma, unacknowledged and diagnosed during post mortem examination.

Summarizing, we can conclude that this study, confirming the findings of several others, demonstrates that the endoscopic polypectomy, performed by an expert hand, is safe and effective and should be considered the treatment of choice also for large colorectal polyps.

Table 6  Recent reports of series on large polyp endoscopic resection and our series

| Authors          | Total (n) | Pedunculated (n) | Sessile (n) | Hemorrhage (%) | Perforation (%) | Other (%) |
|------------------|-----------|------------------|-------------|----------------|----------------|----------|
| Brooker JC et al | 34        | -                | 34          | 17.6           | 0              | 5.9      |
| Hsieh YH et al   | 13        | -                | 13          | 0              | 0              | 0        |
| Brooker JC et al | 100       | -                | 100         | 3              | 0              | 1        |
| Walsh RM et al   | 117       | -                | 117         | 8.5            | 0.8            | 0.8      |
| Iishi H et al    | 56        | -                | 56          | 7              | 0              | 0        |
| Zlatanic J et al | 77        | -                | 77          | 6.5            | 1.3            | 0        |
| Kanamori T et al | 33        | -                | 33          | 9.1            | 0              | 0        |
| Boix J et al     | 74        | -                | 74          | 13.5           | 0              | 0        |
| Bedogni G et al  | 66        | 20               | 42          | 3.1            | 0              | 1.5      |
| Binmoeller K et al | 176   | 47               | 129         | 24             | 0              | 0        |
| Webb WA et al    | 102       | 72               | 30          | 7.8            | 0              | 0        |
| Nivatvongs S et al | 280  | 196              | 84          | 0.7            | 1.8            |          |
| Peretz RF et al  | 147       | 73               | 74          | 5.4            | 1.3            | 0        |
| Dell’Abate P et al | 104  | 49               | 55          | 3.8            | 0              | 0        |
| Jarmel JC et al  | 30        | 6                | 24          | 6.1            | 0              | 0        |
| Doniec JM et al  | 186       | 45               | 141         | 15             | 0.5            | 0        |
| Stergiou N et al | 68        | 27               | 41          | 22.1           | 0              | 0        |
| Consolo P et al  | 160       | 77               | 83          | 6.2            | 0              | 0        |

COMMENTS

Background

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