RESEARCH ARTICLE

Endoscopic Submucosal Dissection Versus Endoscopic Mucosal Resection for the Treatment of Early Esophageal Carcinoma: a Meta-analysis

Jing Wang, Jian Ge, Xiao-Hua Zhang, Ji-Yong Liu, Chong-Mei Yang, Shu-Lei Zhao*

Abstract

Endoscopic submucosal dissection (ESD) was originally developed for en bloc resection of large, flat gastrointestinal lesions. Compared with endoscopic mucosal resection (EMR), ESD is considered to be more time consuming and have more complications for treatment of early esophageal carcinoma, such as bleeding, stenosis and perforation. The objective of this study was to compare the efficacy and safety of ESD and EMR for such lesions. We searched databases, such as PubMed, EMBASE, Cochrane Library and Science Citation Index updated to 2013 for related trials. In the meta-analysis, the main outcome measurements were the en bloc resection rate, the histologically resection rate and the local recurrence rate. We also compared the operation time and the incidences of procedure-related complications. Five trials were identified, and a total of 710 patients and 795 lesions were included. The en bloc and histologically complete resection rates were higher in the ESD group compared with the EMR group (odds ratio (OR) 27.3; 95% CI, 11.5-64.8; OR 18.4; 95% CI, 8.82-38.59). The local recurrence rate was lower in the ESD group (OR 0.13, 95% CI 0.04-0.43). The meta-analysis also showed ESD was more time consuming, but did not increase the complication rate (P=0.76). The results implied that compared with EMR, ESD showed better en bloc and histologically resection rates, and lower local recurrence, without increasing the incidence of procedure-related complications in the treatment of early esophageal carcinoma.

Keywords: Endoscopic submucosal dissection - endoscopic mucosal resection - early esophageal carcinoma

Materials and Methods

Search strategy

Databases including PubMed, EMBASE, the Cochrane Library, and Science Citation Index updated to August 2013 to identify related articles in English language that compared EMR and ESD were searched by us. All bibliographies were indentified in the reference list. The searching terms were “EMR or endoscopic mucosal resection” and “ESD or endoscopic submucosal dissection”. Major proceedings of international meetings (such as Digestive Disease Week, Asian Pacific Digestive Week, and so on) were also hand-searched.

Study selection

The inclusion and exclusion criteria are shown in Table 1.

Data extraction

Data were extracted by one investigator and confirmed by the other according to a predefined data extraction form. Disagreements were resolved by consultation with a third investigator. The following data were collected: year of publication, first author, country, duration, number of
Table 2. The Key Characteristics of the Included Studies

<table>
<thead>
<tr>
<th>Year of publication</th>
<th>First author</th>
<th>Country</th>
<th>Duration</th>
<th>Patients</th>
<th>Lesions</th>
<th>Mean age</th>
<th>Tumor size (mm)</th>
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<tr>
<td>2008</td>
<td>Ishihara R</td>
<td>Japan</td>
<td>2002.1-2007.10</td>
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<td>ESD 31</td>
<td>ESD 64</td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<td>EMRC 68</td>
<td>EMRC 65</td>
<td>EMRC 12±5; 2-channel</td>
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<td></td>
<td>2-channel</td>
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<td></td>
<td></td>
<td>EMR 72</td>
<td>EMR 64</td>
<td>EMR 12±5; 2-channel</td>
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<td></td>
<td>EMR 184</td>
<td>EMR 66.4</td>
<td>EMR 20±11; 2-channel</td>
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<td>ESD 116</td>
<td>ESD 67.1</td>
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<td>ESD 184</td>
<td>EMR 66.4</td>
<td>EMR 20±11; 2-channel</td>
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<td>EMR 184</td>
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<td>EMR 184</td>
<td>EMR 20±11; 2-channel</td>
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<tr>
<td></td>
<td>Teoh AY</td>
<td>China</td>
<td>2002.1-2007.12</td>
<td>ESD 18</td>
<td>ESD 22</td>
<td>ESD 67.5</td>
<td>ESD 24.3±9.8; EMR 11.5±3.5.</td>
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<td>A total of 112</td>
<td>EMR 71</td>
<td>EMR 56</td>
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</table>

Statistical analysis

All data extracted were entered in the freeware program Review Manager (Version 5.0 for Windows, Cochrane Collaboration). The weighted mean difference was recommended for continuous data, and the odds ratio (OR) with 95% confidence intervals (CI) was recommended for dichotomous data. Statistical heterogeneity between trials was evaluated by the chi-square test and was considered to be present when \( P < 0.1 \). We also used I^2 to assess the heterogeneity. I^2 more than 50% was considered to be statistical significance. In the absence of statistically significant heterogeneity, only the OR by the fixed effect model is given in the results. In the presence of statistical heterogeneity, heterogeneity was explored by subgroup analysis or a random-effects model.

Results

Study selection

A total of 705 potential studies were retrieved for the meta-analysis, 577 were excluded for not including the esophageal carcinoma. 123 were excluded because EMR and ESD were not compared. The remaining 5 eligible studies (Iishi et al., 2008; Takahashi et. 2010; Teoh et al., 2010; Urabe et al., 2011; Yamashita et al., 2011) were chosen for further analysis (Figure 1). A total of 795 lesions were included in the meta-analysis, including 319 lesions in the ESD group and 476 lesions in the EMR group. All of the studies were respective case-control studies, not randomized controlled trials (RCTs). The key characteristics of the studies are listed in Table 2.

En bloc resection rate

The en bloc resection rate was reported in all of the 5 studies. No heterogeneity was detected in the 5 studies (\( P = 0.46; I^2 = 0\% \)), a fixed effect model was applied. The analysis showed a higher en bloc resection rate in the ESD group (314/319) than in the EMR group (299/476) (OR 27.32; 95% CI, 11.51-64.81) (Figure 2).

Histologically resection rate

In the present 5 studies, the histologically resection rate was reported. There was heterogeneity among the studies (\( P = 0.02, I^2 = 65\% \)). We excluded the study with the smallest samples (8), and the heterogeneity was eliminated
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In the present analysis, 5 retrospective studies were included, the results confirmed ESD showed higher rates for en bloc resection and histologically complete resection of the lesions than EMR. Local recurrence rate was lower in the ESD group without increasing the risk of complications. On the other hand, ESD is more time-consuming may be attributed to the complex procedure and more time is needed to stop bleeding during operation.

EMR is an endoscopic technique designed for removal of sessile or flat neoplasms confined to the superficial layers (mucosa and submucosa) of the gastrointestinal tract and is typically used for removal of lesions smaller than 2 cm or piecemeal removal of larger lesions (ASGE TECHNOLOGY COMMITTEE et al., 2008). For large lesions, incomplete resection is common, which can lead to local recurrence. ESD is a newly developed and epoch-making method, which has been developed for en bloc removal of large (usually larger than 2 cm), flat gastrointestinal tract lesions. The shortcomings of ESD were more time-consuming, higher rate of procedure related complications and more costly (Ohkuwa et al., 1988; Hirao et al., 1998; Yamamoto et al., 1999; Ono et al., 2001; Kato et al., 2005).

Actually, the meta analysis by Cao et al. (2009) compared clinical outcomes of ESD with EMR in the treatment of tumors of the gastrointestinal tract, they found that ESD showed better en bloc and curative resection rates and local recurrence, but was more time-consuming and had higher rates of bleeding and perforation complications. Lian et al. (2012) demonstrated that ESD is more promising, but it had the disadvantages of higher complication rates for perforation and bleeding.

The comparison between ESD and EMR in the treatment of early esophageal carcinoma is still controversial. Therefore, we designed the meta-analysis to systematically evaluate the two techniques, providing evidence for endoscopic treatment of early esophageal carcinoma. In the view of the present meta-analysis and all available trials, we suggest that ESD is appropriate to most of the lesions, the reason is that ESD has higher resection rate without increasing the procedure related complications.

In summary, based on the findings of our meta-analysis, ESD showed considerable advantages over EMR for early esophageal carcinoma regarding en bloc resection, histologically complete resection rate, and local recurrence even for small lesions, without increasing the procedure-related complication rate. Yet, more high quality trials including early esophageal carcinoma patient are needed to prove the effectiveness of ESD.

Figure 3. Histologically Complete Resection Rate Comparing ESD and EMR

Figure 4. Local Recurrence Rate Comparing ESD and EMR

Figure 5. Procedural Time Comparing ESD and EMR

(P =0.55; I²=0%). A fixed effect model was applied, the subsequent analysis showed the histologically resection rate was significantly higher in the ESD group (289/297) than in the EMR group (307/463) (OR 18.42; 95% CI, 5.55-60.30; Figure 6). We ruled out the study from China (Teoh et al., 2010), heterogeneity still existed (P<0.01, I²=71%).

Table 3. Procedure-related Complications Comparing ESD and EMR

Discussion

In summary, based on the findings of our meta-analysis, ESD showed considerable advantages over EMR for early esophageal carcinoma regarding en bloc resection, histologically complete resection rate, and local recurrence even for small lesions, without increasing the procedure-related complication rate. Yet, more high quality trials including early esophageal carcinoma patient are needed to prove the effectiveness of ESD.

References


