Conventional versus Doxorubicin-eluting Bead Transarterial Chemoembolization for Hepatocellular Carcinoma

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ABSTRACT

Purpose: To compare short- and long-term clinical outcomes after conventional transarterial chemoembolization and drug-eluting bead (DEB) transarterial chemoembolization in hepatocellular carcinoma (HCC).

Materials and Methods: Patients with unresectable HCC unsuitable for ablative therapies were randomly assigned to undergo conventional or DEB chemoembolization. The primary endpoints of the study were safety, toxicity, and tumor response at 1 month. Secondary endpoints were number of repeated chemoembolization cycles, time to recurrence and local recurrence, time to radiologic progression, and survival.

Results: In total, 67 patients (mean age, 70 y ± 7.7) were evaluated. Mean follow-up was 816 days ± 361. Two periprocedural major complications occurred (2.9%) that were treated by medical therapy without the need for other interventions. A significant increase in alanine aminotransferase levels 24 hours after treatment was reported, which was significantly greater after conventional chemoembolization (n = 34) than after DEB chemoembolization (n = 33; preprocedure, 60 IU ± 44 vs 74 IU ± 62, respectively; at 24 h, 216 IU ± 201 vs 101 IU ± 89, respectively; \( P = 0.007 \)). No other differences were observed in liver toxicity between groups. At 1 month, complete and partial tumor response rates were 70.6% and 29.4%, respectively, in the conventional chemoembolization group and 51.5% and 48.5%, respectively, in the DEB chemoembolization group. No differences were observed between groups in time to recurrence and local recurrence, radiologic progression, and survival.

Conclusions: Conventional chemoembolization and DEB chemoembolization have a limited impact on liver function on short- and long-term follow-up and are associated with favorable clinical outcomes.

ABBREVIATIONS

ALT = alanine aminotransferase, BCLC = Barcelona Clinic Liver Cancer, DEB = drug-eluting bead, HCC = hepatocellular carcinoma

Randomized studies have confirmed the efficacy of transarterial chemoembolization for the treatment of patients with unresectable hepatocellular carcinoma (HCC), with a statistically significant improvement in survival in comparison with best supportive care (1–3). Currently, transarterial chemoembolization is considered the first-line treatment option for unresectable HCC in patients with well preserved liver function (4,5), although there is still little consensus regarding the best technique for transarterial chemoembolization, with a wide range of options in delivery systems, drugs, and embolic agents that can be used.
Transarterial chemoembolization with drug-eluting beads (DEBs) is a relatively new technique that uses microspheres as embolic material, loaded with a chemotherapeutic agent that is gradually released into the target lesion. Clinical studies have shown the efficacy and safety of DEB chemoembolization for the treatment of unresectable HCC (6,7). Also, benefits of DEB chemoembolization versus bland embolization have been reported in terms of better local response, fewer recurrences, and longer time to progression (8). Recently, a multicenter international randomized trial (9) compared short-term outcomes of DEB chemoembolization and conventional chemoembolization in terms of impact on liver function and radiologic tumor response. However, data regarding mid- and long-term clinical outcomes are still limited. The purpose of the present prospective, single-center randomized study was to evaluate short-term and long-term technical and clinical results of conventional chemoembolization and DEB chemoembolization in a series of patients with cirrhosis and unresectable HCC.

MATERIALS AND METHODS

Study Setting and Design

This prospective, randomized, single-center study was conducted at the departments of gastroenterology and interventional radiology of our university hospital from January 2006 to March 2009. Consecutive patients with liver cirrhosis and no more than five previously untreated unresectable HCC nodules not suitable for ablative treatments, who met the inclusion/exclusion criteria (described later), were randomly assigned in a 1:1 ratio (based on a computer-generated list) to undergo conventional chemoembolization or chemoembolization with DEBs. Randomization was conducted in an open fashion. The study protocol conformed to the ethical guidelines of the 2008 Declaration of Helsinki and was approved by our institutional review board.

Inclusion and Exclusion Criteria

Inclusion criteria for the study were (i) age greater than 18 years; (ii) bilirubin level lower than 3 mg/dL, aspartate aminotransferase and alanine aminotransferase (ALT) levels lower than 270 IU/L; (iii) serum creatinine level lower than 2 mg/dL; (iv) well preserved Eastern Cooperative Oncology Group performance status (ie, score 0/1) and Child–Pugh class A or B disease (10); (v) untreated HCC unsuitable for percutaneous treatments or hepatic resection; (vi) diagnosis of HCC according to European Association for the Study of the Liver criteria (4); (vii) no more than five tumor nodules and/or tumor burden less than 50% of liver volume; (viii) absence of thrombus in the main portal vein; and (ix) absence of extrahepatic metastases and/or macrovascular invasion.

Patients were excluded from the study in the cases of (i) contraindication to digital subtraction angiography; (ii) chronic comorbidities (pulmonary, cerebral, renal, and cardiac) contraindicating transarterial chemoembolization; (iii) previous (< 5 y) or concomitant neoplastic diseases other than HCC; (iv) localized or systemic infections (other than responsive HIV); (v) pregnancy or breastfeeding; and (vi) any condition impairing or potentially impairing patient compliance with the study.

Preprocedural Assessment

HCC was diagnosed according to European Association for the Study of the Liver criteria (4). Biopsy was not performed in any case. We evaluated patients according to the Barcelona Clinic Liver Cancer (BCLC) classification (5) and the HCC staging system of the Cancer of the Liver Italian Program (11). Tumor sizes were calculated according to Response Evaluation Criteria In Solid Tumors guidelines (12) by summing the maximum axial diameter of all target lesions visible on cross-sectional images, to a maximum of five lesions. Extrahepatic metastases were ruled out by whole-body computed tomography (CT) and bone scintigraphy.

Chemoembolization Protocols

The chemoembolization procedure was performed under local analgesia, with antibiotic prophylaxis (ceftriaxone 1 g on days 0, 1, and 2) and antiemetic medications. Chemoembolization was performed by selective catheterization of the hepatic segmental arteries supplying the lesions with a 3-F coaxial microcatheter (Tracker 18 vascular access system [Target Therapeutics, San Jose, California] or SP Catheter [Terumo, Somerset, New Jersey]).

In patients treated with conventional chemoembolization, a mixture of iodized oil (Lipiodol Ultra Fluid; Laboratoire Andre Guerbet, Aulnay-sous-Bois, France) and doxorubicin hydrochloride (Pfizer, New York, New York) was injected, followed by selective arterial embolization with an emulsion of grated gelatin sponge particles (SPONGOSTAN Standard; Johnson and Johnson, Gargrave, United Kingdom). The amount of administered iodized oil (10–25 mL; mean, 16.6 mL) and doxorubicin hydrochloride (50–75 mg; mean, 57.0 mg) was empirically chosen based on the number and diameter of lesions.

The DEB chemoembolization protocol consisted of superselective injection of 2–4 mL of DC Bead (100–300-μm particle size; Biocompatibles, Farnham, United Kingdom) loaded with doxorubicin (50 mg per vial; range, 25–150 mg; mean, 55 mg). The beads were mixed with a volume of nonionic contrast medium at a 1:3 ratio before delivery.

Transarterial chemoembolization was considered technically successful when the target lesions were fully embolized, as demonstrated by selective angiography performed at completion of the procedure. Complications were defined according to Society of Interventional Radiology guidelines (13).

Follow-up and Evaluations

All patients underwent triphasic contrast-enhanced CT (LightSpeed Plus; GE Medical Systems, Milwaukee, Wisconsin) 1 month after chemoembolization and every 3 months thereafter. In patients with inconclusive CT find-
ings, dynamic contrast-enhanced magnetic resonance (MR) imaging was obtained. Tumor response was assessed by two radiologists according to the amended Response Evaluation Criteria In Solid Tumors (14). Viable tumor was defined by contrast agent uptake in the arterial phase and washout in portal venous and/or late venous phases. After conventional chemoembolization, nonenhanced and arterial-phase images were compared to discriminate between iodized oil and contrast agent uptake. In some cases, quantitative measurements were obtained by placing regions of interest in specific areas in images at all phases according to the criteria proposed by Kim et al (15); a difference in attenuation value of at least 20 HU between the unenhanced phase and at least one of the contrast-enhanced phases was considered indicative of viable tumor. Chemoembolization was repeated when radiologic findings were indicative of stable disease, progressive disease, or partial response with at least 1 cm residual viable tumor.

Study Endpoints
The primary endpoints of the study were (i) safety, (ii) periprocedural toxicity assessed based on liver function, and (iii) tumor response at 1 month. The secondary endpoints were (i) number of repeated chemoembolization cycles in each treatment arm, (ii) time to recurrence (ie, new intrahepatic lesions) and local recurrence (ie, within the target lesions), (iii) time to radiologic progression (ie, disease progression as to exclude repeated chemoembolization, particularly of metastasis and/or macrovascular invasion), and (iv) survival. All cases of partial response, progressive disease, or stable disease at 1-month follow-up were recorded as local tumor recurrences.

Statistical Analysis
Data were analyzed via descriptive statistics (ie, mean and SD). The comparison between treatment arms was performed with \( \chi^2 \) or Fisher exact tests (for categoric data) as appropriate and a paired \( t \) test (for continuous data). Survival curves were determined by the Kaplan–Meier method and life-table analysis and compared by the log-rank test. A multivariate analysis was carried out to assess the influence of tumor nodule distribution and size on study endpoints as appropriate.

Statistical analysis and sample size calculation were performed with SAS software (SAS, Cary, North Carolina); a two-sided \( P \) value of less than .05 was considered statistically significant.

RESULTS
In total, 67 patients were included in the study, and all patients completed it. The Child–Pugh disease class was A (ie, score of 5 or 6) in 54 patients and B (ie, score of 7–9) in 13 patients (with scores of 8 in four patients and 9 in two patients). Thirty-four patients were randomized to undergo conventional chemoembolization and 33 to undergo chemoembolization with DEBs. At baseline, patients were comparable in terms of clinical (Table 1) and tumor characteristics (Table 2). A mean of 1.4 HCC nodules (range, 1–4) per patient, with a mean size of 41.6 mm ± 23.2 (range, 10–130 mm), were treated. Patients with BCLC class A disease (n = 44) were excluded from percutaneous treatment because of patient intolerance (n = 1; 2.2%), limited lesion visibility on ultrasound imaging (n = 3; 6.8%), or tumor location (n = 40; 91%). Specifically, these 40 lesions were located at the dome of the liver in 12 cases, adjacent to the gallbladder in four cases, and adjacent to major vessels in 13 cases; another 11 lesions were excluded because of an exophytic growth.

All interventions were technically successful, and patients in the two treatment arms received a comparable dose of doxorubicin (\( P = .67; \) Table 2). Two cases of periprocedural major complications (2.9%) occurred: one case of cholecystitis after conventional chemoembolization caused by nontarget embolization and one case of liver failure after

### Table 1. Patient Demographics and Clinical Characteristics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Conventional</th>
<th>DEB</th>
<th>( P ) Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of pts.</td>
<td>34</td>
<td>33</td>
<td>.17</td>
</tr>
<tr>
<td>Mean age ± SD (y)</td>
<td>68.7 ± 8.1</td>
<td>71.3 ± 7.2</td>
<td>.66</td>
</tr>
<tr>
<td>Sex (M/F)</td>
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<td>23/10</td>
<td>.60</td>
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<tr>
<td>Cause of cirrhosis</td>
<td></td>
<td></td>
<td>.60</td>
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<tr>
<td>HCV</td>
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<td>22</td>
<td>.37</td>
</tr>
<tr>
<td>HBV</td>
<td>4</td>
<td>4</td>
<td>.43</td>
</tr>
<tr>
<td>Other</td>
<td>5</td>
<td>7</td>
<td>.37</td>
</tr>
<tr>
<td>Child–Pugh class</td>
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<tr>
<td>A</td>
<td>25</td>
<td>29</td>
<td>.17</td>
</tr>
<tr>
<td>B</td>
<td>9</td>
<td>4</td>
<td>.21</td>
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<tr>
<td>AFP (ng/mL)</td>
<td>67.5 ± 202</td>
<td>662 ± 1679</td>
<td>.06</td>
</tr>
<tr>
<td>Bilirubin (mg/dL)</td>
<td>1.25 ± 1</td>
<td>1.34 ± 1.7</td>
<td>.83</td>
</tr>
<tr>
<td>ALT (U/L)</td>
<td>54.0 ± 38.8</td>
<td>74.1 ± 62.2</td>
<td>.14</td>
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<tr>
<td>GGT (U/L)</td>
<td>103 ± 98</td>
<td>130 ± 138</td>
<td>.39</td>
</tr>
<tr>
<td>ALP (U/L)</td>
<td>243 ± 99</td>
<td>228 ± 101</td>
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<tr>
<td>Albumin (g/dL)</td>
<td>3.74 ± 0.53</td>
<td>7.27 ± 13.2</td>
<td>.14</td>
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<tr>
<td>Serum creatinine</td>
<td>0.89 ± 0.24</td>
<td>0.85 ± 0.25</td>
<td>.55</td>
</tr>
<tr>
<td>(mg/dL)</td>
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<td></td>
<td>.55</td>
</tr>
<tr>
<td>Prothrombin activity (%)</td>
<td>80 ± 12</td>
<td>82 ± 12</td>
<td>.88</td>
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<tr>
<td>MELD score</td>
<td>10.4 ± 2.9</td>
<td>9.3 ± 2.9</td>
<td>.15</td>
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<tr>
<td>CLIP score</td>
<td>0.75 ± 0.62</td>
<td>0.53 ± 0.68</td>
<td>.20</td>
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<tr>
<td>BCLC stage</td>
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<td>.86</td>
</tr>
<tr>
<td>A</td>
<td>22</td>
<td>22</td>
<td>.86</td>
</tr>
<tr>
<td>B</td>
<td>12</td>
<td>11</td>
<td>.86</td>
</tr>
</tbody>
</table>

Note.—Values presented as means ± SD where applicable. AFP = \( \alpha \)-fetoprotein, ALP = alkaline phosphatase, ALT = alanine aminotransferase, BCLC = Barcelona Clinic Liver Cancer, CLIP = Cancer of the Liver Italian Program, DEB = drug-eluting bead, GGT = \( \gamma \)-glutamyl transpeptidase, HBV = hepatitis B virus, HCV = hepatitis C virus, MELD = Model for End-stage Liver Disease.
DEB chemoembolization in a patient with Child–Pugh class B disease. Both cases were successfully treated by medical therapy without the need for surgery or other intervention.

Postembolization syndrome (ie, transient fever, abdominal pain, nausea) occurred in 59.7% of cases: 19 of 34 patients (55.9%) patients after conventional chemoembolization and 21 of 33 patients (63.6%) after DEB chemoembolization \((P = .51)\). All side effects were successfully managed with medical therapy.

Patients were discharged 6.4 days ± 3.1 after chemoembolization (median, 6 d), with no significant difference between treatment arms (mean durations of hospital stay, 5.9 d after DEB chemoembolization and 6.8 d after conventional chemoembolization; \(P = .26\)). The mean hospitalization was slightly longer in patients with postembolization syndrome (6.8 d vs 5.8 d), but the difference compared with patients who experienced no complications was not significant \((P = .20)\).

### Impact on Liver Function

Compared with baseline, a significant \((P < .0001)\) increase in ALT level 24 hours after treatment \(67 \text{ IU} \pm 53 \text{ vs } 161 \text{ IU} \pm 167\) was observed. This increase was significantly \((P = .007)\) greater after conventional chemoembolization compared with DEB chemoembolization. ALT levels had decreased at the time of hospital discharge (mean of 91 IU ± 85 in the whole population). The same trend was observed for bilirubin levels: a significant \((P = .003)\) increase versus preprocedural values (mean, 1.1 mg/dL ± 0.6) was observed 24 hours after chemoembolization (mean, 1.5 mg/dL ± 0.9), with progressive reduction at discharge (mean, 1.4 mg/dL ± 0.7); however, no statistical differences were observed between conventional and DEB chemoembolization. Finally, significant decreases in serum albumin levels \((P = .04)\) and prothrombin activity \((P = .04)\) were observed at discharge (mean, 3.5 mg/dL ± 0.5 and 73.6% ± 11, respectively) compared with baseline values (mean, 3.8 mg/dL ± 0.5 and 78.2% ± 13, respectively), with no difference between treatment arms.

No significant variation in Child–Pugh score was observed in the overall population (baseline, 5.7 ± 1.1; at discharge, 5.8 ± 1.1; \(P = .41\)). Child–Pugh scores increased in four patients (11.8%) and five patients (15.1%) after conventional chemoembolization and DEB chemoembolization, respectively \((P = .71)\).

### Tumor Response at 1 Month

At 1 month, complete response and partial response rates were 70.6% (24 of 34) and 29.4% (10 of 34), respectively, after conventional chemoembolization and 51.5% (17 of 33) and 48.5% (16 of 33), respectively, after DEB chemoembolization (Figs 1, 2); the difference was not significant \((P = .1)\). No cases of stable or progressive disease were observed.

Baseline tumor size was significantly lower in patients with complete response (mean, 36 mm) compared with patients with partial response (mean, 50 mm; \(P = .01\)). Other variables, such as number of tumor nodules and distribution, did not influence the tumor response.

### Chemooembolization Cycles, Tumor Recurrence, Radiologic Progression, and Survival

Mean follow-up in the entire population was 26.8 months ± 11.9 (median, 28.2; range, 1–43.5 mo), with no difference between groups (conventional chemoembolization, 27.2 mo ± 12.2; DEB chemoembolization, 26.4 mo ± 11.7; \(P = .80\)). Two chemoembolization cycles were required in 15 patients (22.4%) and three cycles were required in three patients (4.5%); a single session was performed in the remaining cases. The number of chemoembolization cycles in patients treated with conventional chemoembolization was slightly higher than in those who underwent DEB chemoembolization (1.4 cycles vs 1.1 cycles), although the difference was not significant \((P = .06)\). The number of required chemoembolization sessions was not affected by any other parameter, such as tumor nodule number and size.

Median expected time to recurrence was 12.8 months after conventional and DEB chemoembolization \((P = .99)\), whereas median expected times to local recurrence were 12.8 months after conventional chemoembolization and 8.9 months after DEB chemoembolization \((P = .46\); Figs 3, 4). Radiologic progression was observed in 12 patients (17.9%), with mean expected times of 24.2 months after conventional chemoembolization and 15.6 months after DEB chemoembolization \((P = .64; \text{median not reached; Fig } 5)\).

Fourteen patients (20.9%) died during follow-up, with three of the 14 deaths (21.4%) unrelated to liver cirrhosis and tumor progression. The estimated 24-month cumulative survival rates were 83.6% and 86.8% after conventional chemoembolization and DEB chemoembolization, respectively \((P = .96; \text{Fig } 6)\).

Of note, survival, progression, and tumor recurrence were not significantly affected by BCLC stage; mean over-

<table>
<thead>
<tr>
<th>Table 2. Tumor Characteristics and Main Procedural Data</th>
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<tbody>
<tr>
<td><strong>Variable</strong></td>
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<tr>
<td>--------------</td>
</tr>
<tr>
<td>Tumor nodules</td>
</tr>
<tr>
<td>Mean ± SD</td>
</tr>
<tr>
<td>Range</td>
</tr>
<tr>
<td>Tumor size (mm)</td>
</tr>
<tr>
<td>Mean ± SD</td>
</tr>
<tr>
<td>Unilobar</td>
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<tr>
<td>Doxorubicin dose (mg)</td>
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</table>

Note.—Values in parentheses are percentages. DEB = drug-eluting bead.
all survival times were 31.3 months in cases of BCLC stage A disease and 38.2 months in cases of BCLC stage B disease ($P = .23$).

**DISCUSSION**

Transarterial chemoembolization is considered the first-line treatment option for unresectable HCC that is unsuitable for ablative therapies in patients with adequate liver function (16). Currently, different chemoembolization regimens are available that include absorbable or permanent embolic agents (7,17,18). Preliminary preclinical and clinical studies have supported the use of DC Bead (Biocompatibles UK) to increase tumor response and reduce systemic and local side effects, with very limited impact on liver function (6,7). In the present study, a significant variation in ALT levels was observed after treatment in the overall population. The ALT increase was more pronounced after conventional chemoembolization compared with DEB chemoembolization; nonetheless, ALT levels rapidly decreased in both groups.

The most common reported serious adverse events of transarterial chemoembolization are liver abscess, liver infarction, and cholecystitis, which develop in as many as 2% of patients (19,20). In the present study, the overall rates of major complications and postembolization syndrome were 2.9% and 59.7%, respectively, with no difference between treatment arms. Despite the low incidence of periprocedural complications, the median hospital stay was 6 days, which is longer than reported in other studies. Indeed, as an institutional policy, we usually discharge patients 5–7 days

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**Figure 1.** A 4-cm HCC shows the typical vascular pattern on CT before treatment, being hyperdense in the arterial phase (a) and hypodense in the late venous phase (b). Arterial-phase (c) and late venous-phase (d) CT images at 1 month after conventional chemoembolization show homogeneous retention of Lipiodol with no evident areas of contrast enhancement, which was interpreted as complete response to treatment. Arrows indicate the tumor mass before and after the treatment.
Figure 2. A CT scan acquired before treatment depicts a 3.5-cm HCC in segment VI, which is hyperdense in the arterial phase (a) and hypodense in the late venous phase (b). The patient underwent chemoembolization with DEBs. The 1-month CT examination demonstrates the lesion to be completely hypodense in the arterial (c) and late venous phase (d), corresponding to complete response to treatment. Arrows indicate the tumor mass before and after the treatment.

Figure 3. Kaplan–Meier analysis of tumor recurrence. At 24 months, cumulative recurrence-free rate was 42.4% after DEB chemoembolization and 37.4% after conventional chemoembolization ($P = .99$).

Figure 4. Kaplan–Meier analysis of local tumor recurrence. At 24 months, the cumulative local recurrence–free rates were 36% after DEB chemoembolization and 35.3% after conventional chemoembolization ($P = .48$).
after the procedure, even if no major side effects or complications occur.

Transarterial chemoembolization with DEBs has been associated with a low incidence of doxorubicin-related systemic side effects (7,9). In particular, the incidence of alopecia seems to be lower after chemoembolization with DEBs (approximately 2%) compared with conventional chemoembolization (approximately 20%) (9). In the present study, no doxorubicin-related systemic side effects were observed, probably because of the lower doses of drug administered during conventional and DEB chemoembolization (approximately 55 mg) compared with previous studies (6,9).

Despite this more conservative approach, the 1-month complete response rates were 70.6% and 51.5% after conventional and DEB chemoembolization, respectively, which compare favorably with previous results (6–9). This finding may suggest that, when the procedure is selectively performed, transarterial chemoembolization may provide a high antitumoral effect with a low impact on liver function (21), independently from the embolization technique. Our higher rate of complete response might have also been influenced by the more limited tumor extension in our series, with approximately 65% of patients classified as having BCLC stage A disease.

Regarding mid- and long-term clinical outcomes, we did not observe any significant difference between conventional and DEB chemoembolization in terms of tumor recurrence, time to progression, and overall survival. This result differs from what was recently reported by Dhanasekaran et al (22) in a retrospective study that showed significantly higher survival rates after DEB chemoembolization compared with conventional chemoembolization. However, the study included different numbers of patients in the DEB chemoembolization group (n = 45) and conventional chemoembolization group (n = 26), who were enrolled during different intervals: 2006–2008 for the former and 1998–2005 for the latter (22).

Of note, our data referring to the overall population seems encouraging. In fact, median expected time to tumor recurrence was approximately 1 year, and few patients required multiple chemoembolization cycles. Mean time to radiologic disease progression was more than 2 years, and the 24-month cumulative survival rate was higher than 80%. The latter result might be affected by our enrollment criteria; in fact, the BCLC staging system was not strictly adopted in the study, and HCC lesions were included when percutaneous treatment or hepatic resection were considered unfeasible based on multidisciplinary consensus. As a result, approximately 65% of the patients were classified as having stage A disease according to BCLC criteria. Nonetheless, in this limited study, survival, tumor recurrence, and disease progression were not significantly affected by BCLC classification, with comparable results in patients with stage A and stage B disease.

The present study has limitations, which include its open-label design, its monocentric setting, the overall limited number of patients, and the relatively short follow-up. The preferential use of CT to assess tumor response may be another limitation of the study, in view of possible underestimation of viable tumor (23,24). In the attempt to overcome this limitation, we always compared unenhanced and enhanced images to differentiate between Lipiodol stain and viable enhancing tumor; moreover, in doubtful cases, MR was performed.

Despite its limitations, the present study supports the recognized safety of transarterial chemoembolization in terms of reduced impact on liver function, and the efficacy of conventional and DEB chemoembolization, both of which provide high objective response rates. The less severe increase of ALT levels after DEB chemoembolization could potentially make chemoembolization with DEBs more appealing than conventional chemoembolization.

**Figure 5.** Kaplan–Meier analysis of radiologic disease progression. At 24 months, the cumulative disease progression-free rates were 82.5% after DEB chemoembolization and 80.1% after conventional chemoembolization (P = .64).

**Figure 6.** Kaplan–Meier analysis of overall survival. At 24 months, the cumulative survival rates were 86.8% after DEB chemoembolization and 83.6% after conventional chemoembolization (P = .96).
Moreover, regardless of the technique adopted, chemoembolization seems to be associated with promising mid- and long-term clinical outcomes in terms of recurrence-free time and overall survival.

REFERENCES


