Outpatient Abdominoplasty Facilitated by Rib Blocks

Basil M. Michaels, M.D.
Frederick N. Eko, M.D.
Pittsfield, Mass.

Background: Striving to increase patient comfort and feasibility of performing abdominoplasties as outpatient procedures, investigators have been exploring alternative methods of anesthesia to safely avoid general anesthesia. These techniques may result in decreased narcotic administration, and decreased postoperative nausea and vomiting. The authors have added the use of preoperative local anesthesia rib blocks with sedation to replace general anesthesia in abdominoplasties.

Methods: All cases of abdominoplasty performed by the senior author (B.M.M.) were reviewed from 1999 to 2006 and divided into two groups. Group 1 was composed of 39 operations performed using general anesthesia. Group 2 was composed of 29 operations performed using rib blocks placed by the surgeon and supplemented by intravenous sedation. Chart review collected data on time in the operating and recovery rooms, use of narcotics and antiemetics, frequency of postoperative nausea and vomiting, and patient-reported pain. Possible confounding factors, additional procedures, anesthetic and surgical complications, and the need for hospitalization were also recorded. Statistical analysis with two-tailed Mann-Whitney and chi-square testing was used to reject the null hypothesis when comparing the two groups.

Results: Statistically significant decreases in recovery room time, postoperative narcotics, postoperative nausea and vomiting, and pain were achieved using rib blocks. All other measures were similar for both groups. There were no hospitalizations, pneumothoraxes, major complications or deaths.

Conclusion: Rib blocks placed before the start of surgery result in decreased recovery room times, pain, and postoperative nausea and vomiting, achieving increased patient comfort and feasibility of performing abdominoplasties in the outpatient setting. (Plast. Reconstr. Surg. 124: 635, 2009.)

Approximately 172,500 abdominoplasties were performed in the United States in 2006, and of all cosmetic procedures, 46 percent were performed in office-based facilities, 28.9 percent were performed in freestanding surgery centers, and only 24.8 percent were performed in hospitals. Abdominoplasty, traditionally performed in the inpatient setting, is becoming an outpatient procedure with advancements in anesthetic and surgical techniques. Early discharge to home, decreased costs, and proven safety in performing such procedures in the outpatient setting are the proposed reasons for this trend. Early discharge to home, often on the day of surgery, is possible because many surgeons have become comfortable with the delivery of conscious sedation and other methods that avoid general anesthesia. These techniques result in decreased postoperative nausea and vomiting and decreased recovery room time. Avoiding hospital operating room costs and recovery room costs decreases overall cost for the patient. Multiple authors have shown that abdominoplasty performed in the outpatient setting is safe and effective, with low complication rates.

Using local or regional anesthesia techniques in abdominoplasties, multiple authors have described the avoidance of traditional inhalational anesthesia. From the Berkshire Cosmetic and Reconstructive Surgery Center and the Berkshire Medical Center.

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general anesthesia. Not only do these anesthetics, applied before skin incision, decrease the use of inhalational agents and narcotics with a concomitant decrease in postoperative nausea and vomiting, but postoperative pain may be diminished through the principle of preemptive anesthesia.9–15 Hidalgo described the use of rib blocks for breast augmentation with mixed results.16,17 We describe the use of rib blocks with conscious sedation to facilitate abdominoplasty in the outpatient setting.

We evaluated the use of rib blocks for abdominoplasties performed by a single surgeon at an American Association for Accreditation of Ambulatory Surgery Facilities–accredited outpatient office-based surgery center. From 1998 to 2001, all abdominoplasties were performed with standard general endotracheal anesthesia technique. To decrease the use of general endotracheal anesthesia, postoperative nausea and vomiting, and recovery room time and provide preemptive analgesia, we initiated the use of preoperative rib blocks placed by the surgeon in 2001. We found the use of rib blocks often avoided the need for endotracheal intubation and inhalation agents. This article compares these two groups of patients: patients who received general endotracheal anesthesia alone versus patients who received rib blocks with or without inhalation anesthetics or intravenous sedation.

**PATIENTS AND METHODS**

All charts of abdominoplasties performed by the senior author (B.M.M.) in a single American Association for Accreditation of Ambulatory Surgery Facilities–accredited outpatient office-based surgery suite were reviewed from 1999 to 2006 and divided into two groups. Group 1 was composed of the 39 operations performed using general endotracheal anesthesia administered by a board-certified anesthesiologist or nurse anesthetist, before we began using rib blocks. Group 2 was composed of the 29 abdominoplasties performed using rib blocks placed by the surgeon and supplemented by intravenous anesthesia with additional airway control by laryngeal mask as needed. Both groups were compared for confounding factors, including additional simultaneous operations, preoperative and intraoperative medications, age, body mass index, and American Society of Anesthesiologists scores. American Society of Anesthesiologists class is defined as class I, normal healthy; and class II, patient with mild systemic disease. We operated on no patients with an American Society of Anesthesiologists class III or greater.

The principal outcome measures examined were operating room and recovery room time, presence of postoperative nausea and vomiting, the use of medications to control pain and postoperative nausea and vomiting, and patient-reported pain scales in the recovery room. We defined operating room time as the time from when the patient entered the operating room until the time the patient entered the recovery room. We defined recovery room time as the time from entering the recovery room until the time of ambulation and discharge to home. Pain was assessed on a whole-number, 1 to 10, patient-reported scale, with 1 as least and 10 as most pain. All anesthetic and surgical complications and the need for hospitalization were also recorded. This study was approved by the Institutional Review Board of Berkshire Medical Center and is also in compliance with the Declaration of Helsinki.

The rib blocks were placed bilaterally by the surgeon in the operating room before the start of surgery. The patient was placed in the prone position and given intravenous anxiolytics. The back was prepared with povidone-iodine solution and the block performed using a 25-gauge needle. Each rib was palpated with the surgeon’s non-dominant hand and the needle introduced with his dominant hand in approximately the patient’s midscapular line for the eighth through twelfth ribs and a near paravertebral position for the fourth through eighth ribs. These injection sites were selected for ease of finding the rib even in the moderately obese patient. The surgeon carefully bounced the needle off the rib in a caudal direction until the most cephalad area of the intercostal space was broached. Negative pressure was applied to the syringe to ensure a nonvascular, nonpleural injection. Then, a 2-cc injection of a mixture of 1 cc each of 0.25% bupivacaine and 1% lidocaine with 1:100,000 of epinephrine was made per block (Figs. 1 and 2). The patient was then turned to the supine position and placed in compression boots. As the suprapubic area is usually innervated by nerves below our rib block, additional subcutaneous injections of the aforementioned local anesthetic solution were placed in the proposed incision. The rib block group then had additional intravenous or inhalational anesthesia as necessary, depending on patient comfort (rib block failure) and additional procedures. Patient comfort was defined as the absence of patient motion or patient-reported pain. On occasion, an individual rib block would be inadequate and additional local anesthesia infiltration along that dermatome’s perforators was needed. The number of patients who required in-
Fig. 1. Patient positioning during the rib block technique. The patient should be placed in the prone position over a pillow to open the intercostal spaces. Reprinted from Moore DC, Bridenbaugh LD. Oxygen: The antidote for systemic toxic reactions from local anesthetic drugs. *JAMA*. 1960;174:842-847, with permission from Elsevier.

Fig. 2. Injection of local anesthetic during the rib block technique. The rib should be palpated and the tip of needle hit against rib. The surgeon should bounce the needle off the rib in a caudal direction until just under the rib and aspirate to check for blood or air. Reprinted from Moore DC, Bridenbaugh LD. Oxygen: The antidote for systemic toxic reactions from local anesthetic drugs. *JAMA*. 1960;174:842-847, with permission from Elsevier.
halation anesthesia was recorded. The general endotracheal anesthesia group always received desflurane and intravenous narcotics. The abdominoplasties across the entire series were performed in a manner similar to Lockwood’s technique, with a limited lateral dissection and fascial imbrication from the pubis to the xiphoid.18

Concomitant procedures performed with the abdominoplasties were limited in number and extent such that no operation exceeded a 6-hour maximum operating room time. The number and types of concomitant procedures varied between the two groups; therefore, to control for this variation a subgroup analysis excluding patients with concomitant procedures was performed. This subgroup analysis included all the same measures as the larger analysis.

Data collected from the chart review was entered into an Access database (Microsoft Corp., Redmond, Wash.) and analyzed on an Excel spreadsheet (Microsoft). Statistical analysis was performed with chi-square and Mann-Whitney tests at \( \alpha = 0.05 \) to reject the null hypothesis when comparing the two groups. The standard deviations and ratio of variance were calculated. Computations were performed using XLSTAT 2007.4 (Addinsoft, New York, N.Y.)

**RESULTS**

The two groups were similar with regard to age, body mass index, and American Society of Anesthesiologists score (Tables 1 and 2). The average age in the rib block group was 43 compared with 44 in the general endotracheal anesthesia group. The body mass index of both groups averaged 25, which is expected, as we have set a body mass index limit of 40 in our facility for reasons of safety. The average American Society of Anesthesiologists score was 1.3 in the rib block group and 1.5 in the general endotracheal anesthesia group.

The use of inhalational anesthetics was much higher in the general endotracheal anesthesia group at 97 percent compared with 28 percent in the rib block group. Eight patients (28 percent) in the rib block group had a laryngeal mask placed for inhalational anesthesia, and this usually correlated with concomitant procedures performed, such as breast augmentation. Three of the 29 rib block patients required inhalation anesthesia because of rib block failure. We attempted to avoid use of significant intraoperative narcotics in both groups to decrease recovery room time and postoperative nausea and vomiting. The rib blocks provided satisfactory pain control in the majority of cases in that group. Only one patient in the general endotracheal anesthesia group was managed with propofol and narcotics alone (Table 1).

The groups differed somewhat in the number of concurrent procedures performed. The general endotracheal anesthesia group underwent more concurrent procedures than the rib block group, 35 percent versus 20 percent (Table 3). Nevertheless, the average operating room time was identical in the two groups at 231 minutes (Table 4). This confounding factor is eliminated in our subgroup analysis of abdominoplasty-only patients (Table 5).

We found significant differences in our main outcome measures of recovery room time, severity of pain in the recovery room, and incidence of postoperative nausea and vomiting, supporting our hypothesis that rib blocks placed preoperatively decrease intraoperative and postoperative pain and recovery room time (Table 4). Average time in the recovery room for the rib block group was 116 ± 59 minutes, 65 minutes less than the 181 ± 65 minutes for the general endotracheal anesthesia group \( (p < 0.0001) \). Average patient-reported pain scale score in the recovery room was also significantly less in the rib block group, 2 ± 2 of 10 versus 5 ± 3 of 10 with general endotracheal anesthesia \( (p < 0.0001) \). Patients experienced postoperative nausea and vomiting 14 percent of the time in the rib block group, much less frequently than the 54 percent in the general endotracheal anesthesia group \( (p < 0.0005 \) by chi-square test).

The decrease in patient-reported pain and postoperative nausea and vomiting correlated with amounts of medication administered in the

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**Table 1. Group Comparisons: All Procedures**

<table>
<thead>
<tr>
<th></th>
<th>Average Age (yr)</th>
<th>Average BMI</th>
<th>Average ASA Score</th>
<th>Desflurane Inhalation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rib blocks</td>
<td>( (n = 29) )</td>
<td>43</td>
<td>25</td>
<td>1.3</td>
</tr>
<tr>
<td>GETA</td>
<td>( (n = 39) )</td>
<td>44</td>
<td>25</td>
<td>1.5</td>
</tr>
</tbody>
</table>

BMI, body mass index; ASA, American Society of Anesthesiologists; GETA, general endotracheal anesthesia.

**Table 2. Subgroup Comparisons: Abdominoplasty Alone**

<table>
<thead>
<tr>
<th></th>
<th>Average Age (yr)</th>
<th>Average BMI</th>
<th>Average ASA Score</th>
<th>Desflurane Inhalation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rib blocks</td>
<td>( (n = 28) )</td>
<td>40</td>
<td>24</td>
<td>1.3</td>
</tr>
<tr>
<td>GETA</td>
<td>( (n = 25) )</td>
<td>43</td>
<td>25</td>
<td>1.5</td>
</tr>
</tbody>
</table>

BMI, body mass index; ASA, American Society of Anesthesiologists; GETA, general endotracheal anesthesia.
operating room and recovery room (Table 6). We measured narcotics administered in morphine equivalents (i.e., morphine, 10 mg; hydromorphone, 2 mg; meperidine, 75 mg; fentanyl, 100 μg; or oxycodone/acetaminophen 5/325, 4 tabs). Although the rib block group received less intraoperative narcotics than the general endotracheal anesthesia group (17 mg versus 20 mg), this difference did not achieve statistical significance (p = 0.1). In contrast, the rib block group received significantly less narcotics than the general endotracheal anesthesia group in the recovery room (1.3 ± 2.3 mg versus 6.0 ± 5.1 mg (p < 0.0001).

We measured medications to control postoperative nausea and vomiting as equivalent doses: Zofran (GlaxoSmithKline, Middlesex, United Kingdom), 4 mg; Anzemet (sanofi-aventis, Bridgewater, N.J.), 12.5 mg; Decadron (Merck & Co., Inc., Whitehouse Station, N.J.), 4 mg; Droperidol (Janssen-Cilag Ltd, Beerse, Belgium), 0.625 mg; and Compazine (Trigen Laboratories, Inc., Salisbury, Md.), 25 mg. Each patient received at least one dose of Zofran, Anzemet, or Decadron in the operating room before the procedure and no significant difference was observed between the groups. We expected the decreased use of inhalation anesthetics and intraoperative narcotics to result in less postoperative nausea and vomiting. This was the case and is reflected in the decreased use of antiemetics in the recovery room and the decreased incidence of postoperative nausea and vomiting. The rib block group had significantly less postoperative nausea and vomiting (p < 0.0005) than the general endotracheal anesthesia group by chi-square 2 x 2 test. The rib block group received an average of 0.2 ± 0.4 doses, whereas the general endotracheal anesthesia group received an average of 0.9 ± 1.0 doses, a significant difference (p = 0.001). There were no hospitalizations, pneumothoraces, major complications (e.g., infections, hematomas, major wound breakdown), or deaths.

Our subgroup analysis of abdominoplasty-alone patients mirrors our findings in the larger series. The general endotracheal anesthesia group had 25 patients and the rib block group had 23. Confounding factors were the same, with nearly identical American Society of Anesthesiologists scores, body mass index, and ages (Table 2). With subgroup analysis, the rib block failures are more obvious, with three patients requiring inhalation anesthesia.

After subgroup analysis, the original observations of the main outcome measures persist (Tables 5 and 7), with recovery room times of 184 ± 27 minutes in the general endotracheal anesthesia group and 100 ± 63 minutes in the rib block group (p < 0.0001). Operating room time differed by 7 minutes between the two groups (199 ± 29 minutes in the general endotracheal anesthesia group and 206 ± 29 minutes in the rib block group). Postoperative nausea and vomiting in the recovery room was 15 in the general endotracheal anesthesia group and two in the rib block group (p < 0.0005 by chi-square test). Patient average reported pain scale in recovery room is two of 10 in the rib block group and

Table 3. Concomitant Procedures

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Rejuvenation (%)</th>
<th>Breast Surgery (%)</th>
<th>Extremity Contouring (%)</th>
<th>Herniorrhaphy (%)</th>
<th>Total (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rib blocks (n = 29)</td>
<td>2 (7)</td>
<td>2 (7)</td>
<td>1 (3)</td>
<td>1 (3)</td>
<td>6 (20)</td>
</tr>
<tr>
<td>GETA (n = 39)</td>
<td>1 (2)</td>
<td>6 (15)</td>
<td>4 (10)</td>
<td>3 (8)</td>
<td>14 (35)</td>
</tr>
</tbody>
</table>

GETA, general endotracheal anesthesia.

Table 4. Times and Symptoms: All Procedures

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Average OR Time (min)</th>
<th>Average RR Time (min)</th>
<th>PONV in RR</th>
<th>Average Pain in RR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rib blocks (n = 29)</td>
<td>231 ± 74</td>
<td>116 ± 59</td>
<td>4 (14%)</td>
<td>2 ± 2 of 10</td>
</tr>
<tr>
<td>GETA (n = 39)</td>
<td>231 ± 76</td>
<td>181 ± 65</td>
<td>21 (54%)</td>
<td>5 ± 3 of 10</td>
</tr>
</tbody>
</table>
P value             | <0.0001               | <0.0005               | <0.0001    |<0.0001             |

OR, operating room; RR, recovery room; PONV, postoperative nausea and vomiting; GETA, general endotracheal anesthesia.

Table 5. Times and Symptoms: Abdominoplasty-Alone Subgroups

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Average OR Time (min)</th>
<th>Average RR Time (min)</th>
<th>PONV in RR</th>
<th>Average Pain in RR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rib blocks (n = 23)</td>
<td>206 ± 29</td>
<td>100 ± 63</td>
<td>2 (8%)</td>
<td>2 ± 2 of 10</td>
</tr>
<tr>
<td>GETA (n = 25)</td>
<td>199 ± 29</td>
<td>184 ± 27</td>
<td>15 (60%)</td>
<td>5 ± 3 of 10</td>
</tr>
</tbody>
</table>
P value             | 0.0001                | 0.0005                | 0.008      |                   |

OR, operating room; RR, recovery room; PONV, postoperative nausea and vomiting; GETA, general endotracheal anesthesia.
five of 10 in the general endotracheal anesthesia group \( (p = 0.008) \).

**DISCUSSION**

Mustoe et al. and others have demonstrated that abdominoplasty can be performed safely under conscious sedation.  

Byun et al. reported high patient satisfaction in 20 abdominoplasties performed in an outpatient facility under conscious sedation using fentanyl and versed.  

Kryger et al. reported no increase in complications in 153 consecutive outpatient abdominoplasties performed under conscious sedation.  

Mustoe et al. detailed the use of conscious sedation and local anesthesia for abdominoplasties, with extremely good outcomes and almost no unplanned hospitalizations, and with high patient satisfaction rates.  

Rosenberg et al. described 106 abdominoplasties performed with procedural sedation and local anesthesia.  

They noted that this procedure avoided the complications of general anesthesia and maintained high patient satisfaction.  

All of these authors have demonstrated that abdominoplasty can be performed safely with sedation and locoregional anesthesia alone. Finally, two recent studies—one by Keyes et al. and the other by Stevens et al.—have directly addressed the issue of safety and efficacy of abdominoplasty performed in properly accredited outpatient surgery facilities.  

Both studies confirm that abdominoplasty can be performed in accredited outpatient facilities safely and cost-effectively.  

Some of the above studies have investigated tumescent infiltration for abdominoplasty as part of the local anesthetic infiltration. Potential limitations of tumescent infiltration include a heavier abdominal flap, limited efficacy of electrocautery dissection caused by excessive moisture, and changes of the elasticity of the flap. We wanted to avoid the use of tumescent local anesthetic while using conscious sedation during abdominoplasty yet still provide a means of preemptive analgesia that would decrease the need for inhalation anesthetics and intraoperative narcotic use.

Rib blocks as a method of preemptive analgesia is commonly used in thoracic and abdominal surgery with good results. The incidence of pneumothorax with rib blocks has been reported to occur between 0.07 and 0.42 percent. 

Lönnqvist et al. have studied the failure rate and incidence of complications of rib blocks. They reported an overall failure rate as high as 10.1 percent, comparable to our failure rate of 10.3 percent (three of 29). 

In these studies, the authors also report hypotension in as many as 4.6 percent, vascular puncture in 6.8 percent, pleural puncture in 1.1 percent, and pneumothorax in 0.5 percent of cases. These were complication rates comparable to epidural and spinal anesthesia.  

Although we did not record the incidence of vascular and pleural puncture in our patients, we found no cases of hematoma, hemothorax, or pneumothorax. From the period of this study until submission of this article, the senior author (B.M.M.) has used a rib block technique on all breast augmentations and abdominoplasties, with no resulting pneumothorax \( (n = 94) \). On occasion, rib blocks may produce areas of spotty anesthesia, and usually require some form of additional sedation, but they can be performed easily by the surgeon preoperatively.

The use of analgesia before the onset of pain, most commonly referred to as preemptive anal-
gesia, is a well-documented and established principle. Kissin defines preemptive analgesia as “a treatment that prevents establishment of the altered sensory processing that amplifies postoperative pain.”

Although the definition and clinical effectiveness of preemptive analgesia has been debated in the literature, when viewed in the context of central sensitization resulting from incisional and inflammatory injury as defined by Kissin, it is a valid clinical phenomenon. This view of preemptive analgesia is based on the notion that postoperative pain and hypersensitivity result not only from incisional injury during the surgical procedure but also from the central hyperexcitability of nociceptive receptors as a result of postoperative inflammatory changes at the operative site. As such, adequately performed preemptive analgesia not only decreases nociceptive afferent stimuli before incision but also prevents postoperative central hyperexcitability by controlling the immediate postoperative inflammatory response. Kissin and others argue strongly for the use of various analgesic agents in adequate dosing and administration intervals to ensure adequate duration of action to last through the immediate postoperative period to circumvent the effects of the inflammatory injury phase of central sensitization.

Our use of rib blocks is based on this principle and likely explains the significant difference between the two groups in terms of perioperative narcotic use, and subsequent recovery room analgesia, and postoperative nausea and vomiting.

Byun et al. published data in 1999 demonstrating the safety of outpatient abdominoplasties under conscious sedation anesthesia and showed that time in the outpatient facility after surgery was related directly to the intraoperative fentanyl dosage that patients received, possibly related to postoperative nausea and vomiting. We show a similar decreased use of intraoperative narcotics and inhalational anesthesia correlated with decreased recovery times. In the study by Byun et al., the mean recovery room time was 235 minutes, which is more than double our recovery room time of 116 minutes when we used rib blocks. The preoperative use of rib blocks takes advantage of preemptive analgesia and decreases the use of additional anesthetic medications, resulting in decreased postoperative nausea and vomiting and recovery room times. Rib blocks add approximately 15 minutes to the preoperative time and save over 1 hour of recovery room time, making this a cost-effective technique and an improvement in patient comfort.

Despite our small sample sizes, we were able to demonstrate statistically significant differences in the amount of postoperative narcotic medication use, postoperative nausea and vomiting, and recovery room time with the use of rib blocks. Time to ambulation was shorter in rib block patients than in general endotracheal anesthesia patients, resulting in a theoretical decreased risk of deep venous thrombosis. We experienced a failure of rib blocks in three patients who required general anesthesia with inhalation agents. These failures occurred sporadically throughout the series. Further studies will elucidate the learning curve. In general, the effectiveness of the rib blocks can be extrapolated from the outcome measures.

Limitations of the study include the variable use of inhalation anesthetics and narcotic use in the two groups. It is possible the variable recovery room narcotic use resulted in increased postoperative nausea and vomiting, which led to longer recovery room times in the general endotracheal anesthesia group. Rib block patients had less pain in the recovery room and thus required less narcotics.

An additional theoretical limitation of the study is the possibility that the fascial imbrication performed in the abdominoplasties may have been slightly different between the two groups because of differences in muscle relaxation. It is the authors’ contention that the same amount of imbrication was performed in the two groups, although this is difficult to prove.

Our subgroup analysis of abdominoplasty-alone patients confirms the larger series findings. Interestingly, we observed a 7-minute average difference between the subgroups in operating room time, most likely representing rib block administration. The difference in recovery room time is even greater between the two subgroups. The effect of the rib blocks is seen more clearly when concomitant procedures are eliminated from the analysis.

Outpatient abdominoplasty can be performed safely in appropriately accredited outpatient facilities by appropriately trained plastic surgeons. The use of preemptive analgesia in the form of rib blocks decreases the amount of inhalation anesthetics and intraoperative narcotics used. This results in decreased postoperative narcotic requirements and decreased postoperative nausea and vomiting. This translates into decreased recovery room times and a better operative experience for the patient. By taking advantage of this simple method of preemptive analgesia, we have been able to decrease anesthetic use, intraoperative narcotic use, and recovery room time while providing a safe and pleasant operative experience for our patients undergoing abdomino-
We conclude that rib blocks facilitate abdominoplasty in the outpatient setting.

Basil M. Michaels, M.D.
426 South Street
Pittsfield, Mass. 01201
basil.michaels@gmail.com

REFERENCES