Are postoperative activity restrictions evidence-based?

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Abstract

Background: Many surgeons restrict activities postoperatively. Intra-abdominal pressure during some activities is known; however, many everyday activities have not been studied. Our aim was to compare the intra-abdominal pressures created during unavoidable physical activities with activities that commonly are restricted after surgery.

Methods: Nine healthy subjects (2 men, 7 women; age, 28 ± 7 y) performed 5 repetitions of various activities while their intravesicular pressure was measured.

Results: The resting intravesicular pressure was 17 ± 5 mm Hg, increasing to a maximum of 112 ± 35 mm Hg during forceful coughing. The intravesicular pressure increase was greatest with forceful coughing, followed by the Valsalva maneuver.

Conclusions: The results suggest that the greatest increase in intra-abdominal pressure occurs during some unavoidable activities. Based on this study, postoperative restrictions may be unnecessary. Further experience based on a larger study is needed to answer this important clinical question. © 2008 Elsevier Inc. All rights reserved.

Keywords: Intra-abdominal pressure; Intrabladder pressure; Abdominal pressure; Activity restrictions; Postoperative restrictions; Wound breakdown; Dehiscence; Restrictions

Intra-abdominal pressures generated during lifting have been studied for nearly 50 years. The biomechanical role of intra-abdominal pressure remains poorly understood and widely debated [1]. Intra-abdominal pressure has been shown to increase consistently during lifting tasks and also can be increased by performing the Valsalva maneuver [1,2]. Intra-abdominal pressures have been studied in relation to urinary incontinence, spinal stability, intradiscal pressures, and pelvic floor disorders. Few studies have been performed that analyzed intra-abdominal pressures during everyday activities [3].

Postoperative activity restrictions are authorized routinely by multiple specialties for various reasons. These restrictions are used in an effort to minimize increased intra-abdominal pressure, which is thought to increase the breakdown of the surgical repair or closure. Many retrospective reviews cited increased intra-abdominal pressure as an instigator of wound dehiscence [4–9]. Common restricted activities include lifting of more than 10 to 20 lb, exercising, strenuous activities, housework, and even the use of stairs. These activity restrictions are not only surgery-dependent, but also physician-dependent, because not all physicians are in agreement regarding restrictions after common surgeries such as hernia repairs [10]. When postoperative restrictions are used, they place significant limitation on patients’ daily activities and can negatively impact patients’ lives.

Although some information is available regarding intra-abdominal pressure during various lifting activities, most studies did not simulate everyday activities [11,12]. The aim of our study was to evaluate the intra-abdominal pressure created by unavoidable activities such as coughing, sneezing, or rising from a chair when compared with activities that are restricted commonly after surgery. Our goal was to determine if the current practice of limiting postoperative activity is supported by evidence, or if further studies would be needed to generate a more evidence-based approach to postoperative activity restrictions.

Methods

We recruited 9 healthy subjects (2 men, 7 women) who had no known medical condition that limited their activities. Subjects were between 18 and 40 years of age. During the experiment, subjects simulated everyday activities (per-
forming 5 repetitions of each activity) while bladder pressures were measured via a Foley catheter connected to an arterial-line pressure transducer. We requested that all participants empty their bladder before the start of the study. Activities included coughing, rising from a chair, standard sit-ups, the Valsalva maneuver, and a series of lifting tasks. The lifting tasks included lifting a 10-lb, 20-lb, and 40-lb dumbbell from the floor and table height to an established standing position. Participants were instructed to lift the weight to chest height with extended arms flexed 90° from their body. When lifting the weight from the floor, the subjects were instructed to bend their knees and lift by straightening their legs and to exhale during the lifting phase. Intra-abdominal pressures were measured using the peak pressure obtained (while performing the activity). Each activity was performed 5 times, and the mean of the 5 values was used to describe the peak pressure. The mean peak pressures also were determined for each activity. Our local institutional review board approved the study and all participants underwent an informed consent process before entering the study.

Results

The mean age of the group was 28 ± 7 years.

The change in intra-abdominal pressure for each activity was consistent between subjects, such that those activities that produced the highest and lowest intra-abdominal pressures did so reliably. The mean peak intra-abdominal pressures for all activities ranged from 28.6 to 112.3 mm Hg. The mean and range values for the peak intra-abdominal pressures generated are depicted in Table 1 in order of ascending mean value. A similar trend was seen with net pressures (data not shown).

Peak and net intra-abdominal pressures were greatest with forceful coughing and the Valsalva maneuver and lowest while lifting 10 lb from table height. There was wide intersubject variability in both net and peak pressures for all activities, with larger intersubject variability seen in activities that generated higher intra-abdominal pressures. Despite numerous attempts, we were unable to have participants sneeze during the course of the experiment. While attempting to have participants sneeze, however, many participants began laughing and, although the data were not recorded officially, it was noted that higher intra-abdominal pressures were obtained by laughing than with any of the other activities except forceful coughing.

It also was noted during the study that the starting position of the participant did affect the maximum pressure generated during the activity. For example, the intra-abdominal pressures generated by lifting the weight from the floor were consistently higher than the pressures created when the same amount of weight was lifted from the table.

We made multiple comparisons between various lifting activities in an attempt to compare activities that commonly are restricted after some surgeries with activities that cannot be practically restricted. We have included the data that compare these unrestrictable activities to lifting various amounts of weight.

Interestingly, rising from a seated position to a standing position, both with and without the assistance of one’s arms, generated intra-abdominal pressures similar to those created by lifting 10 lb from the floor and 20 lb from a table.

Performing a light cough, defined as clearing one’s throat, increased intra-abdominal pressure significantly more than rising from a seated positions with (P < .008) and without (P < .02) arm assistance, as well as lifting 10 lb from table height (P < .007) and lifting 20 lb from table height (P < .03). Performing a forceful cough increased intra-abdominal pressure greater than all other activities measured, including lifting 10 lb, 20 lb, and 40 lb from the floor and table height, light cough, and the Valsalva maneuver (P < .007 for all activities).

The Valsalva maneuver increased intra-abdominal pressure more than most activities including lifting 10 lb, 20 lb, and rising from a seated position; although performing the Valsalva maneuver did not increase intra-abdominal pressure significantly more than did clearing one’s throat or lifting 40 lb from the floor or a table.

Comments

Many activities that cannot be practically restricted, such as coughing, clearing one’s throat, and the Valsalva maneu-

<table>
<thead>
<tr>
<th>Activity</th>
<th>Mean</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Range*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resting seated</td>
<td>16.9</td>
<td>9.0</td>
<td>25.0</td>
<td>16.0</td>
</tr>
<tr>
<td>Resting standing</td>
<td>22.9</td>
<td>14.0</td>
<td>42.0</td>
<td>28.0</td>
</tr>
<tr>
<td>Lift 10 lb from table</td>
<td>28.6</td>
<td>15.8</td>
<td>44.8</td>
<td>29.0</td>
</tr>
<tr>
<td>Seated to standing with hand assistance</td>
<td>33.3</td>
<td>8.6</td>
<td>59.0</td>
<td>50.4</td>
</tr>
<tr>
<td>Standard sit-up</td>
<td>33.6</td>
<td>11.6</td>
<td>54.0</td>
<td>42.4</td>
</tr>
<tr>
<td>Seated to standing without hand assistance</td>
<td>35.0</td>
<td>19.8</td>
<td>58.8</td>
<td>39.0</td>
</tr>
<tr>
<td>Lift 20 lb from table</td>
<td>37.2</td>
<td>19.0</td>
<td>51.6</td>
<td>32.6</td>
</tr>
<tr>
<td>Lift 10 lb from floor</td>
<td>39.8</td>
<td>17.0</td>
<td>56.0</td>
<td>39.0</td>
</tr>
<tr>
<td>Lift 20 lb from floor</td>
<td>48.2</td>
<td>19.2</td>
<td>65.6</td>
<td>46.4</td>
</tr>
<tr>
<td>Light cough (clearing one’s throat)</td>
<td>60.0</td>
<td>30.0</td>
<td>101.2</td>
<td>71.2</td>
</tr>
<tr>
<td>Lift 40 lb from table</td>
<td>63.3</td>
<td>24.0</td>
<td>85.6</td>
<td>61.6</td>
</tr>
<tr>
<td>Lift 40 lb from floor</td>
<td>69.8</td>
<td>21.8</td>
<td>107.6</td>
<td>85.8</td>
</tr>
<tr>
<td>Valsalva maneuver</td>
<td>77.1</td>
<td>42.8</td>
<td>112.8</td>
<td>70.0</td>
</tr>
<tr>
<td>Forceful cough</td>
<td>112.3</td>
<td>56.4</td>
<td>180.0</td>
<td>123.6</td>
</tr>
</tbody>
</table>

* Difference between minimum and maximum.
ver, generate intra-abdominal pressures that are greater than those created by activities currently restricted in postoperative patients. These results suggest that we re-examine the validity of current postoperative restrictions and consider a more evidence-based approach to creating appropriate guidelines. Because postoperative restrictions may limit many activities of daily living and can delay return to work, in turn costing both patient and employer lost revenue, such limitations need to be based on evidence-based guidelines.

Pressures recorded in our subjects for the various activities followed the same general trend as similar studies that have been performed in the past [3]. Previous studies have shown that intra-abdominal pressure is reflected accurately by transurethral measurement of bladder pressure [13,14]. Intra-abdominal pressure measurements typically are performed with patients in the supine position, therefore we believe that increased pressures noted in our subjects in the resting seated and resting standing positions are related to the weight of the viscera on the bladder [15]. Of note, although each activity generated similar trends in pressure changes, we did observe high levels of intersubject variability.

Starting position was shown to affect the overall intra-abdominal pressure created, with more pressure being created by lifting from the floor, than lifting the same weight from table height. This knowledge may permit previously restricted activities with simple adjustments in the way the activity is performed.

Although the activities performed in our study were designed to reflect those performed during normal everyday life, it is impossible to simulate real life in a laboratory. Further, we examined peak pressures during many lifting activities but did not assess elements such as duration of lifting or fatigue. For example, although lifting 40 lb from table height 5 times (as in our study) does not increase pressure more than coughing, we do not know the cumulative effects of repeatedly lifting this amount.

No studies could be found that directly correlated increased intra-abdominal pressure to increased wound tension, however, previous animal studies have been performed that have studied the burst strength of hernia repairs related to increased intra-abdominal pressure. One study by Brockman et al [16] reported the burst strength of early open and laparoscopic hernia repair to be 289 mm Hg and 259 mm Hg, respectively, and late (6 weeks) open and laparoscopic hernia repair to be 289 mm Hg and 291 mm Hg, respectively. These intra-abdominal pressures far exceeded any created during our experiment, and are more than double the pressure created by forceful coughing, 112 mm Hg, which was statistically greater than all other activities studied.

Given the results of this study, our current postoperative recommendations are that patients may resume normal activities as tolerated with the exception of activities in which they could fall from an elevated height, such as falling from a ladder.

Limitations of the present study included the small sample size, the accuracy of the bladder pressure when measured with an arterial-line pressure transducer, inconsistent effort of participants, ability to generalize results to patient populations, and use of peak pressures instead of average pressure during the activity. The use of the average pressure created during the activity may aid in predicting how a repair would react to repeated or prolonged pressures, instead of just isolated peak pressures.

Conclusions

Intra-abdominal pressures generated by unavoidable activities such as forceful coughing and the Valsalva maneuver were greater than the pressures created by many currently restricted activities, such as lifting 20 lb or even 40 lb. The starting position of a lifting activity does impact the overall pressure created, with more pressure generated when lifting the same weight from a lower height. The evidence from this study does not support current postoperative activity restrictions, and further larger studies are needed to generate more evidence-based guidelines.

References


Discussion

James G. Tyburski, M.D. (Detroit, MI): First, the resting and seated pressures were 16 and 22. These pressures are starting to approach intra-abdominal hypertension in some studies. Can you comment on this? Is it because you use 120 cc in the bladder? It is very interesting that the standing position was much higher.

Really the phenomenon that you are looking here is not
intra-abdominal pressure but actually abdominal wall tension. When you do a sit-up, you generate a very low power, but it seemed to me that you had a transverse abdominal incision, it would put quite a bit of pressure on that incision, so is this the surrogate for that? Is it really the abdominal wall tension we are looking for rather than intra-abdominal pressure?

Were there any breathing instructions given during the lifting? If the Valsalva cranked the pressures up to 120, if somebody was lifting 40 pounds in Valsalva, it seemed to me that that would be important. That would override the lifting. Did they have any breathing instructions, any lifting instructions, they should breathe out when they lifted? Did you tell these ahead of time, because maybe that is part of our postoperative instructions? And then the forceful cough, as you mentioned, had the highest mean pressures other than the unofficial laughing measurements. Has this influenced what you tell your patients to do postoperatively with the incision? If you would restrict them from lifting 50 pounds and 40 pounds, what do you tell them about their pulmonary toilet, not to cough?

I also now know that if I have any trouble with dehiscence, it is not my talent as a surgeon, but it is my talent as a comedian. My patients are laughing too much postoperatively and that is why they run into trouble.

Robert Guttormson, M.D.: With regard to the resting pressure, both seated and standing, we were also surprised to learn that some of the pressures were increased compared to what we were expecting. I think some of this has to do with the patient population that we had. The patients were in a standard seated position. None of the patients that we had were morbidly obese, however, many of them were overweight by current standards. I did not measure that during this study because it has been shown in multiple studies to have effect on the total pressure created, but it was interesting to note that the resting pressure for one of the patients in this study was 26 or 27, which would meet the criteria we currently use for abdominal hypertension.

As far as the second question with regards to the abdominal wall tension versus the abdominal wall pressure, that is accurate. This is something that we discussed with the other authors, and there is not a simple way for us to measure how much tension is created on the inside of the abdominal wall in a noninvasive method. So that is not something that we have been able to study, but we are using the pressure as surrogate for the amount of tension that would be created.

The subjects were given lifting instructions. They were told to bend at the knees, keep a straight back, and breathe out while they were standing throughout this, and there was a very specific peak in each of the activities. It was not like the pressure went up and stayed high throughout the entire activity. There was an isolated peak during each movement, and that is what was measured. The last question you asked was about forceful coughing and if that has changed the restrictions or the recommendations after surgery. We have not changed our recommendations, because this was simply a pilot study, and it was done with so few subjects, however, we do pay a lot more attention when patients are coming out of anesthesia and we want to make sure that they do not cough when they are getting extubated because we have seen where patients have had a dehiscence immediately postoperatively during the extubation period because they started coughing while still in the operating room.

Peter T. Hallowell, M.D. (Cleveland, OH): What are your current recommendations for patients with abdominal wall hernia in light of your new data?

Robert Guttormson, M.D.: We ask patients not to lift anything over 15 to 20 pounds for the first 2 weeks and then we ask patients after that point not to lift anything over 40 pounds until approximately 4 to 6 weeks after surgery. If patients have some problem with these restrictions, then we try to work out a solution so that they can return to work with modified duties, or if there is any other activities that we can specifically address. Golfing seems to come up an awful lot, and we ask them to only work on their short game for the first 6 weeks after an operation.