### RESULTS

Five relevant studies were located with our PICO search. Four studies met our inclusion and categorized as shown in Table 1. One additional study investigating occlusion training and serum chemistry was located but not included in this Critically Appraised Topic (CAT) because it did not measure muscle strength or hypertrophic changes. Additionally, one study investigating occlusion training and kinematics could select BFR cuffs, but the study was not included in the CAT because it did not measure muscle strength or hypertrophic changes.4,5

### DISCUSSION AND CONCLUSIONS

Four studies met our inclusion criteria and were reviewed for this CAT. All four investigations reported a significant increase in muscle strength or hypertrophy achieved with BFR and training. These findings indicate in general, BFR is an effective augmentation to traditional resistance training regimens regardless of risk of occlusion having been previously explored and minimized.1,3,5,6

These results were achieved with the implementation of cuffs or wraps that prevented venous return in the limb. It is suggested that only 50-100 mmHg of pressure is needed to prevent venous return.7,8 In a clinical setting, sphygmomanometer cuffs may be utilized to assure proper occlusion is achieved. Common lifting wraps or commercial BFR straps can be used for a more practical application in the weight room.3,9

### CLINICAL SCENARIO

In exercise science, athletic training, occupational therapy, and the clinical setting, sphygmomanometer cuffs may be utilized to assure proper occlusion is achieved. Common lifting wraps or commercial BFR straps can be used for a more practical application in the weight room.3,9

### METHODS

#### Search Strategy

Terms Used to Guide Research

Patient/Client Group: College and Athlete

Intervention: Vascular Occlusion or Blood Flow Restricted Training

Comparison: No Intervention and Control

Outcomes: Increased Muscle Strength and Hypertrophy (College and Athlete) AND (Vascular Occlusion or Blood Flow Restricted Training) AND (No Intervention and Control) AND Increased Muscle Strength or Hypertrophy

### Sources of Evidence searched

- PubMed
- PEDro Database
- CINAHL
- Sport Discus
- Additional resources obtained via review of references lists and hand search

#### Inclusion and Exclusion Criteria

Criteria that must be met for an article to be included:

- Male only
- College Sport
- Level 3 evidence or higher
- Limited to the last 12 years (2002-2014)
- Limited to the English language
- Limited to humans
- Exclusion
- Non-contact sports
- Female sample

#### Level of Evidence / Validity

Table 1. Characteristics of Included Studies

<table>
<thead>
<tr>
<th>Study</th>
<th>Participants</th>
<th>Intervention</th>
<th>Outcome Measures</th>
<th>Main Findings</th>
<th>Level of Evidence / Validity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cook et al (2014)</td>
<td>Twenty male semiprofessional rugby union players (Age: 21.5 ± 1.4 years, Height: 1.84 ± 0.05 m, Mass: 95.6 ± 10.4 kg) participated.</td>
<td>Performed 3 exercises (leg squat, bench press, and weighted pull up) at 80% of their 1RM. 5 sets of 5 repetitions. Lower limb blood flow was restricted with an occlusion cuff inflated to 200 mmHg for both leg exercises. During the exercise and debrief after the training period, 4 sets of exercises were performed with no occlusion.</td>
<td>Primary outcomes: Pre and post test for 1RM bench press, 1RM leg squat, and girth measurements. Secondary outcomes: Subject compliance</td>
<td>Follow up ultrasound ANOVA indicated a significant difference for 1RM squat in the group that completed high-intensity training with BFR. 1RM bench and leg press were not significantly different.</td>
<td>Validity: N/A</td>
</tr>
<tr>
<td>Lumbers et al (2014)</td>
<td>Group 1: high-intensity training only with no BFR. Group 4: modified training, supplemented training with BFR. The supplemental training consisted of bench press and squat activities using only 20% 1RM.</td>
<td></td>
<td></td>
<td></td>
<td>Validity: N/A</td>
</tr>
<tr>
<td>Takarada et al (2002)</td>
<td>Group 1: high-intensity training only with no BFR. Group 4: modified training, supplemented training with BFR. The supplemental training consisted of bench press and squat activities using only 20% 1RM.</td>
<td></td>
<td></td>
<td></td>
<td>Validity: N/A</td>
</tr>
<tr>
<td>Yamamaka et al (2012)</td>
<td>Group 1: high-intensity training only with no BFR. Group 4: modified training, supplemented training with BFR. The supplemental training consisted of bench press and squat activities using only 20% 1RM.</td>
<td></td>
<td></td>
<td></td>
<td>Validity: N/A</td>
</tr>
</tbody>
</table>

#### REFERENCES