angle $\beta$, however valuable, has a major shortcoming in that it does not distinguish between the various shapes that are determined by the same relationship between the three determinants of angle $\beta$ (the vital capacity, peak expiratory flow and mid-vital capacity forced expiratory flow). This is illustrated in the Figure, where completely different and realistic maximal expiratory flow-volume (MEFV) curve shapes will yield similar values for the angle $\beta$. The same problem exists for previous attempts at quantifying the complex MEFV curve shape by a single variable such as the index proposed by Green et al or Landau et al's mid-vital capacity curvilinearity score. In my opinion, adequate quantification of the MEFV curve shape requires a more complex analysis such as Mead's slope-ratio-volume relationship that analyzes the curve on a point-by-point basis, or a method that quantitates various segments of the curve rather than its overall contour, such as the chord slope analysis I proposed previously. It nevertheless is encouraging to see that, with other authors, Kapp et al point to the usefulness of the analysis of the configurational aspects of the MEFV curve, showing that configurational parameters may contribute to the clinical utility of this test.

Walter G. Vincken, M.D., Ph.D., F.C.C.P.,
Academic Hospital,
University of Brussels,
Brussels, Belgium

REFERENCES
4 Vincken W. Analysis of the configuration of the maximal expiratory flow-volume curve. Chest 1986; 89:488S

To the Editor:

Dr. Vincken raises interesting observations which deserve further comment. We agree with his statement that "the difficulty is in expressing configurational information, which is readily available by visual inspection of the shape of the flow-volume loop, in numerical indices to be able to quantify and compare various shapes." The approach which we chose was to reduce this configuration to a single index (angle $\beta$) which could be easily derived from available parameters (in this case peak flow, Vmax50 and FVC). This index has intuitive geometric meaning and our analysis has shown that it is useful in documenting or defining individual and group respiratory abnormalities.

The specific criticism that Dr. Vincken raises is eminently plausible although its actual importance remains to be tested. Certainly we do not mean to argue that characterizing the configuration of the MEFV curve by a single index uniquely characterizes the shape of the MEFV curve. Clearly, such a characterization would have to take into account many more (if not all points) on the MEFV curve, as does chord slope analysis. What we hoped to avoid in selecting a single parameter was an analysis so cumbersome as to discourage its usefulness. After all, FEV, does not characterize all flow rates on the MEFV curve yet its determination and study has proven empirically quite useful in measuring respiratory function. While Dr. Vincken's figure suggests that a given angle $\beta$ would, in fact, characterize a number of curves with dissimilar shapes, we would like to qualify this criticism. For a given individual the variation between maneuvers of angle $\beta$ within a series of blows or even between days is small (see Tables 6 and 7 of our study), suggesting that $\beta$ may serve as a useful parameter for comparisons in a single individual.

The question of the variability of angle $\beta$ between individuals is more complex and as can be appreciated from Dr. Vincken's figure depends to a great extent on the position of the volume at which peak flow occurs (relative to TLC). In a preliminary analysis of this question we have reviewed 34 MEFV curves from separate individuals and have found that the volume below TLC at which peak flow occurs (expressed as a percent of FVC) is restricted to a narrow range: 16.1 ± 7.3 percent (mean ± SD). This restriction implies that not all configurations of the MEFV curve are probable and that, in fact, some are distinctly unlikely. This observation suggests to us that $\beta$ may be more specific for a given flow volume shape than is implied by Dr. Vincken. Clearly, the issues which Dr. Vincken raises demand further careful analysis. We hope that his thoughtful reflections will stimulate more work on a measurement which we consider will prove useful both conceptually and empirically.

E. Neil Schachter, M.D.;
Mary C. Kapp, Ph.D.;
Gerald J. Beck, Ph.D.;
Theodore J. Witek, Jr. Ph.D.;
Mark Pilipaski, and
Lucinda R. Mauder, M.A.,
Mount Sinai Medical Center,
New York

Catheter Complications

To the Editor:

We read with great interest Scott's review of "Complications Associated with Central Venous Catheters, A Survey" (Chest 1988; 94:1221-24). Recently we reported a very unusual complication of CVCS—namely venobronchial fistula.' This occurred six months after insertion of a Hickman catheter for systemic chemotherapy. The patient suffered transient episodes of hemoptysis after removal of catheter, but this rapidly disappeared and she subsequently required no major intervention.

Although Scott's findings indicate 'that complications were primarily health professional technique-related', we believe that our case illustrates that a complication may develop as a result of the infusion through the CVC itself.

In addition, we seriously question the findings that infection is not a reported complication of CVCs. Those of us who insert and utilize these devices on a regular basis know that everything from simple insertion-site cellulitis to full-blown septic shock can occur. In this regard the MDR system seems to have failed.

Clearly the benefits of CVC use for a variety of diagnostic and therapeutic procedures are obvious. Although complications do exist in both short- and long-term central venous catheterization, we believe that this should not deter their use in clinical practice.

Richard D. Kimmel, D.O.,
Department of Cardiovascular and Thoracic Surgery,
Deborah Heart and Lung Center,
Browns Mills, Nj; and
Gerald R. Swiacki, D.O., FACOS,
Attending Surgeon,
Botsford General Hospital,
Farmington Hills, MI

REFERENCES
1 Kimmel RD, Swiacki GR. Venobronchial fistula: a rare complication of long-term central venous catheterization for chemothera-

CHEST / 97 / 5 / MAY, 1990 1271
Nasal Mechanical Ventilation (NMV) as an Alternative to Continuous Positive Airway Pressure (CPAP) in Sleep Apnea

To the Editor:

A proportion of patients with obstructive sleep apnea, perhaps as many as 15 percent, fail to respond to nasal CPAP. This may be due to one of several problems including intolerance of the tight-fitting nose mask or the discomfort induced by continuous positive pressure. In addition, some fail because the tendency of the airway to close exceeds the ability of nasal CPAP to act as a pneumatic splint. We wish to report one such patient, a 35-year-old Hispanic man, who was subsequently successfully treated using NMV delivered by the same nasal mask and substituting a pressure respirator (Bird Mark 7) for the blower motor (Fig 1).

The patient presented with hypersomnolence which had caused him to lose successive jobs. Polysomnography confirmed the presence of severe obstructive sleep apnea (apnea index 57/hr with a mean duration of 22.1 ± 11.7 s, minimum oxygen saturation 75 percent). Evaluation of his nose and pharynx revealed no correctable abnormality and efficacy of conventional nasal CPAP was assessed in a separate sleep study. A maximum pressure of 15 cm H2O was only partially successful (apnea index 37/hr with a mean duration of 17.3 ± 10.4 s); when used regularly there was no relief of his disabling symptoms.

<table>
<thead>
<tr>
<th>SATURATION %</th>
<th>CHEST WALL</th>
<th>HEART RATE</th>
<th>APNEA</th>
</tr>
</thead>
<tbody>
<tr>
<td>0–10</td>
<td>30–50</td>
<td>60–90</td>
<td>60–120</td>
</tr>
</tbody>
</table>

![Graph showing saturation, chest wall, heart rate, and apnea variations](image-url)