

## PNEUMOTHORAX ITS INCIDENCE FOLLOWING BRACHIAL PLEXUS BLOCK ANALGESIA \*

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In discussing the advantages and disadvantages of brachial plexus nerve block analgesia, the high incidence of pneumothorax has often been mentioned as a reason for not using this type of anesthesia.

The available literature on brachial plexus block was reviewed, but almost without exception there was little concerning the incidence of pneumothorax other than mention of its infrequent occurrence (1-27). Exceptions to this were articles by Griswold and Woodson (28), Dmarjian (29), Bonica, Moore and Orlov (30), and Bonica and Moore (31) in which the incidence of pneumothorax was stated to be 2, 1, 0.82 and 0.66 per cent respectively. In these four studies, no special analysis of pneumothorax was made unless the patients had signs and symptoms of the complication. Therefore, if silent pneumothorax does occur as noted by some, perhaps the percentages of this complication are greater (32).

It was the purpose of this study to determine as accurately as possible the incidence of pneumothorax following brachial plexus block analgesia. The term "as accurately as possible" is used because previous studies indicate that after a physician has performed a large number of brachial plexus blocks he becomes more adept, and the number of instances of pneumothorax decreases (30, 31, 33).

### METHOD OF STUDY

Routine anteroposterior roentgenograms of the chest were taken ten to fifteen hours after brachial plexus block analgesia in 100 consecutive patients. In addition, lateral and oblique exposures were made in those patients who had chest pain but no air was apparent in the anteroposterior film. It is emphasized that the patients were not screened in any manner, but the study comprised 100 consecutive patients who received brachial plexus block analgesia over an eight month period. The supraclavicular approach as previously described by one of the authors (D. C. M.) was used in all cases (33). Pontocaine® (tetracaine) hydrochloride was the local anesthetic agent em-

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ployed. Roentgenograms were not made routinely before the block procedure.

### RESULTS

Five patients complained of severe chest pain on the side blocked within six hours after the execution of the brachial plexus block. They could not take deep breaths or lie on the side which had been blocked without exaggerating the pain. They complained of dyspnea but showed no signs of acute oxygen want. In only one of these 5 patients was it possible to demonstrate air intrapleurally although both oblique and lateral exposures were made of the 4 patients in whom no air was seen on the routine anteroposterior chest film.

Another patient in this study had a previously collapsed lung on the side blocked and volunteered the information only when he was told he was to have a roentgenogram of the chest. This patient had no subjective symptoms from the collapsed lung and appeared to be obviously an ideal patient for a brachial block.

TABLE 1  
SUMMARY OF COMPLICATIONS

Physician	No. of Blocks	Pneumothorax	Chest Pain
1 (D. C. M.)	52	0	2
2 (C. K. O.)	19	0	1
3 (L. G. A.)	7	0	0
4 (L. D. B.)	22	1	2

No complications other than the one case of pneumothorax and the 4 cases of pain without demonstrable pneumothorax occurred in this series (table 1).

The ages of the patients in this study ranged from 6 to 74 years. Forty-five were emergency cases and did not have complete histories and physical examinations. The physical status of this group was classified according to the American Society of Anesthesiologists, Inc., code as physical status 5. The remainder had complete histories and physical examinations, and their physical status was classified according to the same code as follows: 46, status 1; 7, status 2, and 2, status 3. There were seventy-four open operations, twenty-five closed manipulations, and one therapeutic block in the series. Four anesthesiologists participated in this study (table 1).

### DISCUSSION

The incidence of pneumothorax in this series of 100 consecutive brachial plexus blocks was 1 per cent. We found no instance of

"silent" pneumothorax resulting from the procedure. This is much less than "cloak room conversation" might indicate and shows that the complication is not a formidable argument against the use of brachial plexus block analgesia. At the Mason Clinic we have found that although a pneumothorax may cause discomfort, it is not serious provided a correct evaluation of its extent is made by roentgen examination, suitable treatment instituted and the situation tactfully explained to the patient. In the one patient in this series who had a pneumothorax the lungs re-expanded within two to five days with no treatment and the complication did not extend his hospitalization.

Roentgenologic examination was delayed until ten to fifteen hours after the execution of the block because we have found that although the patient may complain immediately of the symptoms of pneumothorax, the signs often do not appear for six to fifteen hours (33). The delayed appearance of air in the pleural cavity on roentgen studies and physical examination is attributed to the fact that most instances of pneumothorax are caused by lung puncture with slow leakage of air from the lung, not air entering the chest through the needle.

Although 4 of the 5 patients complained of chest pain simulating pneumothorax, no evidence of air in the pleural cavity could be found on the roentgenogram. It is our opinion that in these cases the pain was the result of stimulation of the long thoracic nerve during the performance of the block or the irritation of the pleura from either excessive spread of the anesthetic solution or trauma from the point of the needle. The first mentioned factor seems to be the more likely. Pain of this nature invariably disappeared not later than the third postoperative day, while it is not uncommon for the pain from a pneumothorax to persist for a week.

The fact as to whether or not "*silent*" pneumothorax occurs in any great number following block analgesia seems to us to be of only academic interest since the patient in no way is discommoded. It was proposed as a possible complication of block analgesia probably on the basis that many patients with spontaneous or therapeutic pneumothorax are asymptomatic. Nevertheless, since it has been mentioned, we believe the following points gleaned on this subject from our studies should be stressed: (1) air in the chest detectable on the roentgenogram after brachial plexus block caused pain and was never silent; (2) the possibility of a "*silent*" pneumothorax following brachial plexus block analgesia is probably hypothetical and is of little significant statistical importance when evaluating the incidence of pneumothorax produced by this procedure.

#### SUMMARY AND CONCLUSIONS

The incidence of pneumothorax in a series of 100 consecutive brachial plexus blocks by four anesthesiologists in which roentgeno-

graphic studies were made following the block procedure was 1 per cent.

The occurrence of "silent" pneumothorax following brachial plexus block in a patient with no previous disease of the lung is questioned.

The possibility of pneumothorax following brachial block is not a substantial argument against its selection and use.

#### REFERENCES

1. Matas, R.: Halsted Memorial Address, *Bull. Johns Hopkins* **36**: 2-27 (Jan.) 1925.
2. Strachauer, A. C.: Brachial Plexus Anesthesia; Complete Local Anesthesia of Upper Extremities Permitting All Major Surgical Procedures, *J. Lancet* **34**: 301-303 (1914).
3. Neuhof, H.: Supraclavicular Anesthetization of Brachial Plexus, *J.A.M.A.* **62**: 1629-1631 (1914).
4. Simpson, J. K.: Supraclavicular Brachial Plexus Block, *J. Florida M. A.* **2**: 161-165 (1915).
5. Livingston, E. M., and Wertheim, H.: Brachial Plexus Block; Its Clinical Application, *Anesth. and Analg.* **6**: 146-154 (June) 1927.
6. Livingston, E. M., and Wertheim, H.: Brachial Plexus Block; Its Clinical Application, *Brit. J. Anaesth.* **4**: 209-220 (April) 1927.
7. Livingston, E. M., and Wertheim, H.: Brachial Plexus Block: Its Clinical Application, *J.A.M.A.* **88**: 1464-1468 (May) 1927.
8. Labat, G.: Brachial Plexus Block: Details of Technique with Lantern Slides, *Anesth. & Analg.* **6**: 81-82 (April) 1927; *Brit. J. Anaesth.* **4**: 174-176 (Jan.) 1927.
9. Hanrahan, E. M., Jr.: Brachial Plexus Nerve Block, *J.A.M.A.* **90**: 529-530 (Feb. 18) 1928; *Brachial Plexus Block*, *Virginia M. Monthly* **55**: 305-306 (Aug.) 1928.
10. Kulenkampff, D., and Persky, M. A.: Brachial Plexus Anesthesia; Its Indications, Techniques, and Dangers, *Ann. Surg.* **87**: 883-891 (June) 1928.
11. Hay, I. M.: Brachial Plexus Anesthesia, *J. Florida, M. A.* **15**: 601-602 (June) 1929.
12. Strode, J. E.: Brachial Plexus Block Anesthesia; Its Advantages in Treatment of Fractures of Arm; Report of Cases, *California and West. Med.* **31**: 17-20 (July) 1929.
13. Rhone, T. B.: Brachial Plexus Anesthesia, *Ann. Surg.* **101**: 1153-1170 (May) 1935.
14. Tuohy, E. B.: Brachial Plexus Block, *Am. J. Surg.* **34**: 544-546 (Dec.) 1936.
15. Tarsy, J. M., and Steinbrocker, O.: Supraclavicular Brachial Plexus Blocks; Accessory Therapeutic Measure in Arthritis of Shoulder Joint and Allied Conditions, *New York J. Med.* **37**: 1275-1278 (July) 1937.
16. Halperin, P. H.: Brachial Plexus Block, *Wisconsin M. J.* **38**: 21-24 (Jan.) 1939.
17. Miltner, L. J., and Chao, C. L.: Brachial Block Anesthesia, *J. Iowa M. Soc.* **29**: 94-93 (March) 1939.
18. Arnold, C. H., and Gibson, L. V.: Brachial Plexus Block, *Southwestern Med.* **23**: 249-250 (Aug.) 1939.
19. Murphy, D. R., Jr.: Brachial Plexus Block Anesthesia; Improved Technique, *Ann. Surg.* **119**: 935-943 (June) 1944.
20. Phillips, R. B.: How to Obtain Good Results with Brachial Plexus Block Anesthesia, *Mill. Surgeon* **95**: 197-199 (Sept.) 1944.
21. Greene, B. A.: Brachial Plexus Anesthesia; Report of 150 Consecutive Cases, *M. Bull. North African Theatre Op.* **2**: 102-104 (Nov.) 1944.
22. Ansbro, F. P.: Method of Continuous Brachial Plexus Block, *Am. J. Surg.* **71**: 716-722 (June) 1946.
23. Hirschel, G.: Die Anästhesierung des Plexus Brachialis für die Operationen an der Oberen Extremität, *München med. Wehnschr.* **58**: 1555 (1911).
24. Kulenkampff, D.: Die Anästhesierung des Plexus Brachialis, *Zentralbl. Chir.* **38**: 1337-1346 (1911).
25. Patrick, J.: Technique of Brachial Plexus Block Anesthesia, *Brit. J. Surg.* **27**: 734-739 (April) 1940.
26. Macintosh, R. R., and Mushin, W. W.: Local Anesthesia—Brachial Plexus, Springfield, Illinois, Charles C Thomas, 1947.

27. Moore, D. C.: Pontocaine Hydrochloride for Brachial Block Analgesia; 150 Cases, *Anesthesiology* 9: 281-284 (May) 1948.
28. Griswold, R. A., and Woodson, W. H.: Brachial Plexus Block Anesthesia of Upper Extremities, *Am. J. Surg.* 59: 439-443 (Feb.) 1943.
29. Damarjian, E.: Brachial Plexus Block—One Hundred Consecutive Cases, *Rhode Island M. J.* 29: 271 (April) 1946.
30. Bonica, J. J.; Moore, D. C., and Orlov, M.: Brachial Plexus Block Anesthesia, *Am. J. Surg.* 78: 65-79 (July) 1949.
31. Bonica, J. J., and Moore, D. C.: Brachial Plexus Block Anesthesia, *Anesth. & Analg.* 29: 241-253 (Sept.-Oct.) 1950.
32. Adriani, J.; Parmley, J., and Ochsner, A.: Fatalities and Complications after Attempts at Stellate Ganglion Block, *Surgery* 32: 615-619 (Sept.) 1952.
33. Moore, D. C.: Regional Block, Springfield, Illinois, Charles C Thomas, 1953.

## PRELIMINARY PROGRAM

### 1954 ANNUAL MEETING

THE AMERICAN SOCIETY OF ANESTHESIOLOGISTS, INC.

NETHERLAND PLAZA HOTEL, CINCINNATI, OHIO

October 25-28, 1954

## SYMPOSIUM ON FUNDAMENTAL RESEARCH

MONDAY, OCTOBER 25, 1954

### MORNING: GENERAL SCIENTIFIC SESSION:

*Studies of Renal Function During Anesthesia*—Leonard Bachman, M.D.

*Chlorpromazine: Clinical and Laboratory Investigation*—C. R. Stephen, M.D., Michel Bourgeois-Gavardin, M.D., and W. K. Nowill, M.D.

*A Study of Certain N-Alkyl Thiobarbiturates*—E. M. Papper, M.D., R. C. Peterson, M.D., J. J. Burns, M.D., Eleonore Bernstein, M.D., P. Lief, M.D., and B. B. Brodie, M.D.

*Some Current Problems in Circulatory Physiology*—Lysle H. Peterson, M.D. *Hemodynamics Studies During Thiopental Sodium and Nitrous Oxide Anesthesia in Humans*—E. Jay Fieldman, M.D., Earl H. Wood, Ph.D., and Roger W. Ridley, M.D.

*The Enzymatic Hydrolysis of Halogen Substituted Local Anesthetic Agents in Human Plasma*—Francis F. Foldes, M.D., D. L. Davis, M.D., and S. P. Shanor, M.D.

### AFTERNOON: GENERAL SCIENTIFIC SESSION:

*The Rational View on Modern Anesthetic Techniques*—Victor Goldman, M.D.

*Anesthetic Management of the Neurosurgical Patient*—John B. Dillon, M.D.

*The Use of Digitalis in Anesthesiology*—Charles C. Wycoff, M.D.

*Intercostal Nerve Block in Upper Abdominal and Chest Surgery*—Howard A. Bennett, M.D.

*Anesthesia Management During Hypophysectomy for Fulminant "Juvenile" Diabetes*—Bruce M. Anderson, M.D., and Laurance W. Kinsell, M.D.

*Anesthesia Equipment from 1914-1954 and Experiments Leading to Its Development*—D. E. Jackson, M.D.

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