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Research of optimal ways for providing oxygen in behalf of critical medicine.
(Critical Care Medicine Institute, Tbilisi, Georgia).

Oxygen supply is of great importance for medical facilities in general and to facilities of critical medicine in particular. Besides, in conditions of significant volumes of consumption and restricted resources the oxygen becomes a strategic resource. Existing ways of oxygen supply are complicated, expensive and explosive. The issue of wide appliance of technology on the basis of pressure swing adsorption is being considered. Attention is paid to application of mobile oxygen concentrators directly at patient's bed. It is suggested to use mobile concentrators for supply of stream-oriented ALV devices in case of their insignificant changes. It is recommended to use this approach for supply clinics with oxygen, especially in conditions of limited financial resources.

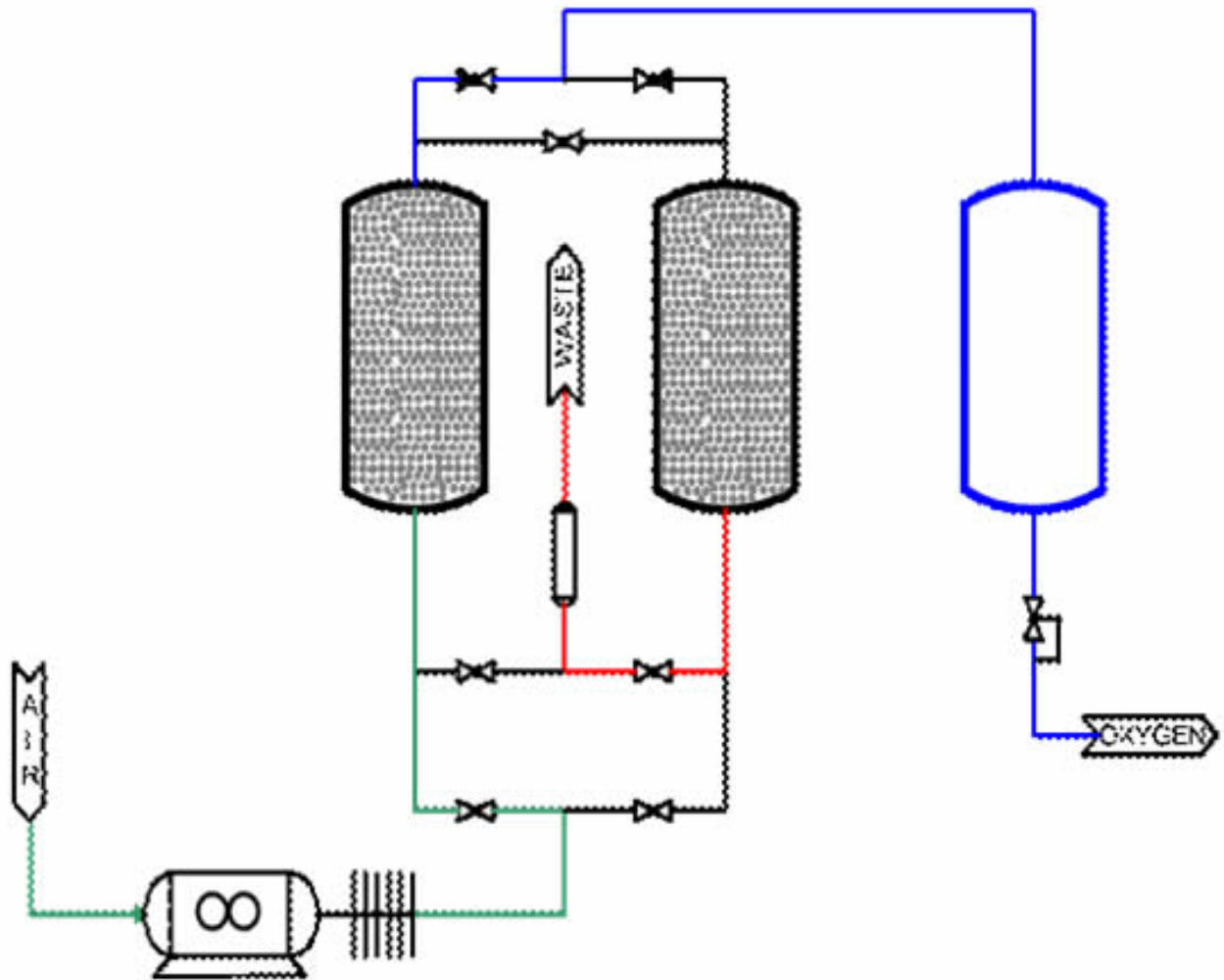
Key Words: Oxygen, Critical Care, Strategic resource.

Intraduction: Oxygen is needed as for patients, who are on spontaneous breathing as well as for patients on artificial ventilation of lungs. Consumption of oxygen increases during surgical interference and during narcosis. Therefore, in medical protocols oxygen is one of the most needed medications for critical patients. Such increased consumption of oxygen in many countries causes increase of its cost. Besides, ensuring supply of large amounts of oxygen becomes complicated technical task for clinics. This makes search for optimal ways for ensuring oxygen need from the point of view of decreasing oxygen consumption as well as cheap ways of its production. The work aimed at insurance of optimal ways of production of oxygen – cheap, reliable, and simple in using and ensuring nonstop supply of oxygen.

Materials and Methods: Clinic of critical medicine of Georgian Institute of critical medicine was chosen as a model for the given research. About 1000 of critical patients undergo treatment in this clinic every year. Besides the department of critical medicine, the clinic also has department of general surgery, neurosurgery, anesthetic department and others. Departments of critical medicine, surgery and other departments of this facility were supplied from centralized oxygen station and special oxygen network. Balloons with condensed oxygen were used as an emergency source of oxygen supply.

Operational use of oxygen station is suspended at the moment and it remains only as an emergency source of oxygen supply.

The scheme for obtaining oxygen from air by PSA



Results and discussion:

The main source of oxygen supply at the moment is an alternate system of oxygen supply. The alternate system of oxygen supply is based on the method of receiving oxygen from air by means of mobile concentrators. These concentrators work on the basis of PSA (pressure swing adsorption) technology. Compressed air is supplied to column with adsorbent, which holds nitrogen and lets oxygen through. For restoration of adsorbent, it should be washed with small amount of oxygen. As a rule, there are two such columns and they work alternately. Mobile concentrators on the basis of PSA allow receiving oxygen directly at patient's bed; they are reliable, cheap, simple in usage and completely explosion-proof. In case of increase of cots, growth of oxygen production is achieved by comparatively cheap mobile concentrators, while in case of oxygen station it should be bought again. Initial costs of oxygen station are hundred times higher than purchasing of concentrators. Besides, there are expenses for a separate premises, oxygen distribution and staff. Oxygen is mainly consumed by patients with spontaneous breathing, patients on artificial ventilation of lungs and patients during surgery. Patients with spontaneous breathing are supplied with oxygen from concentrator directly through nasal oxygen tube. In case of absence of independent breathing, mix of air and oxygen is supplied by means of a ALV device. These devices are of two types – piston and

stream-oriented. Stream oriented ALV devices use ejection pump for producing mix of air and oxygen. Oxygen of high pressure is supplied through a central nozzle and the air of low pressure (atmospheric) is suck. Afterwards the mix is supplied to the patient.

However, mobile concentrators have low pressure of oxygen at the output and it is impossible to connect them directly to stream-oriented ALV devices. We have switched oxygen supply and air into ejection pump. Air of high pressure should be supplied from compressor of mobile concentrator or separate compressor through the central nozzle. Oxygen from concentrator is suck by ejection pump. Calculations show, that at the average value of inhalation of 700 ml., frequency of inhalation 15 per minute and 40% of content of oxygen in supplied mixture it necessary to have concentrator with capacity 5 l/min. Oxygen is sucked only in the phase of breathing. But concentrator produces oxygen continuously. If accumulating capacity is adjust the phase of breathing can be used as well and concentration of oxygen may reach 67%.

Conclusion: Switching to alternative means of oxygen at the same consumption allowed decreasing financial costs by 8-9 times. Actually, it is the cost of electricity, consumed by concentrators. Therefore, we recommend this approach for supply of clinic with oxygen, especially in conditions of limited financial sources.

References

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 ჟანგბადით უზრუნველყოფის ოპტიმალური გზების მოძიება კრიტიკული
 მედიცინისთვის.
 (კრიტიკული მედიცინის ინსტიტუტი, თბილისი, საქართველო)

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