

# Cases Study of the Effectiveness of Ozone Gas Therapy on the Treatment of Resistant Meningitis in Infants with Hydrocephalus

## Abstract

Hydrocephalus brings great difficulties to Neurosurgeons when it is accompanied with resistant meningitis, because placing a Ventriculo-peritoneal shunt is a contraindication in the presence of meningitis and from the other side quick and safe treatment helps preserve brain's mantle from dystrophy due to hydrocephalus.

We tried a new method (not used before) and it was highly effective against this kind of resistant meningitis - Ozone Therapy Intrathecaly. A five to six sessions of Ozone gas therapy with a dose of 40µg/ml intrathecaly each other day was able to cure from resistant meningitis in 2 infants with hydrocephalus.

## Case Report

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**Mazen KB Dahhan\***

Vänernborg, Sweden

\*Corresponding author: Mazen KB Dahhan, Storgatan 19, lgh: 0003, 46236 Vänernborg, Sweden, Email: mkbd\_77@yahoo.com

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## Introduction

Hydrocephalus brings great difficulties to Neurosurgeons when it is accompanied with resistant meningitis, because placing a Ventriculo-peritoneal shunt (the gold standard of treating hydrocephalus in infants) is a contraindication in meningitis and from the other side the need for quick and safe treatment helps preserve the brain's mantle ability from dystrophy due to hydrocephalus

This Hydrocephalus may last for a long time if the shunt is not placed quickly, and there is a need to avoid unnecessary treatments such as external ventricular drainage or repeated CSF evacuation which may bring minimal damage to the brain cortex.

In this study, we present two infants suffering from hydrocephalus, after CSF analysis was done bacterial meningitis was discovered and the bacteria showed high resistance on treatment with usual treatment options, we tried a new method (not used before) and it was highly effective against this kind of resistant meningitis - Ozone Therapy Intrathecaly.

Both cases were treated with antibiotics intrathecaly (injected inside dilated ventricles), but because of the resistant nature of the bacteria, cure from meningitis was not achieved, in one case an external shunt drainage was placed and intraventricular antibiotics were injected with simultaneous intravenous treatment with other antibiotics.

## Material & Methods

### Case 1

Maha Al Jumaa - a 2 months old infant, was presented since birth with communicating Hydrocephalus, as a rule we had to take CSF for analysis before making a decision of shunt placement (Table 1).

Table 1

WBC	Neu/Lym	RBC	Protein	Glucose	Color
357	90/10	2500	300	15	Yellow turbid

A bacterial growth shows growth of gram-negative Bacteria: *Pseudomonas Aeruginosa + Staphylococcus Aureus*, no sensitivity for over 20 recent antibiotics including 3<sup>rd</sup> Generation of Cephalosporins.

The microbial growth analysis was done with the method of (Microgen) with the usage of both Resin and Thioglycolate to cover any unwanted effects from antibiotics that the patient may have taken before. The treatment started with the placement of an external shunt with injection of Gentamycin 10 mg with Amikacin 30 mg daily intrathecaly (although Gentamycin and Amikacin showed no effect on the bacterial incubation - but hopefully they can give some effect as a last chance).

Plus intravenously with Vancomycin 20 mg/kg in 3 doses and Ceftazidime 50 mg/kg in 3 doses. (Before the injection of antibiotics into ventricles an amount of about 50 ml of CSF was withdrawn from the ventricles and after that both antibiotics were injected - in case to reduce hydrocephalus and keep the brain mantle status with no tension to improve the general and neurological status of the patient and to increase the concentration of antibiotics within CSF to get full effectiveness).

After 2 weeks CSF Analysis was as follows (Table 2):

The external shunt was removed after CSF analysis showed an improvement after 2 weeks of treatment.

At 3<sup>rd</sup> week CSF analysis has improved but not to cure from meningitis (Table 3)

CSF analysis was done once weekly, with the bacterial growth test which in week 3 showed not sensitivity also to Imipenem. The above treatment was given for another 2 weeks with transfontanel needle aspiration of CSF and intravenous antibiotal treatment. With fixed results of CSF after 2 weeks from shunt removal we had to search for other treatment options.

**Table 2**

WBC	Neu/Lym	RBC	Protein	Glucose	Color
250	90/10	1000	220	20	Yellow turbid

**Table 3**

WBC	Neu/Lym	RBC	Protein	Glucose	Color
50	95/5	250	250	18	Yellow slightly turbid

After consultation with Dr. S. Kalieh- who has expertise with Ozone gas therapy and certified with this kind of treatment- a suggestion was made after consulting his mentors who said that this treatment wasn't done before, but it was used in many studies for many other diseases including septicemia, hepatitis, MS, ulcers and it was given (Ozone gas) with blood, urine, and it was effective and safe and has a bactericidal, fungicidal and virus-inactivating properties. We searched the literature of Neurosurgery but there was no treatment of meningitis with Ozone.

**Ozone Therapy has Effects on:**

- 1) Red blood cells: Improvement of rheological properties.  
Activation of red blood cell metabolism with increase of 2, 3-DPG and ATP, plus resultant improvement in O2 release.
- 2) Action on immunocompetent cells: moderate activation of mononuclear cells with release of cytokines.  
Because there was no other choice left, and the patient had a bad prognosis if not cured and the general and neurological situation was deteriorating, we explained to the parents that this kind of treatment wasn't an option before and we had to take the risk and start treatment with Ozone.

All other antimicrobial treatments were stopped since they showed no effectiveness after 2 weeks.

The decision was made by starting with a low dose of Ozone gas concentration (mixed with pure Oxygen) since results were not clear - 20 µg/ml (the safe dose for systemic applications). Then, with higher dose of 40 µg/ml per session each other day.

Ozone Device Company we keep hidden in this article- we can give under request if needed (but it is one of the leading companies in Germany with expertise above 50 years). An amount of 50ml of CSF was aspirated from the ventricles, a 25ml was taken away, and the remaining 25 ml was used to be mix with Ozone gas with Pure Oxygen. A Butterfly needle was kept in place while the CSF was mixing with Ozone.

The mixing period was done for about 2 minutes.

**Caution!! NO** gas shape volume allowed to be injected into ventricles.

Just the Ozone gas needed to be diluted into CSF after shaking the liquid of CSF with Ozone gas gently for a time period about 2 minutes (the color of CSF changes slightly inside the 50ml syringe). After the second session the CSF shape and color became much better (from near orange color to no color and from turbid to near transparent).

This was confirmed with CSF analysis as following (Table 4):

Before the last session CSF was as following (Table 5):

A period of 7 days was suggested and another CSF analysis was done before surgery (Table 6).

**Table 4**

WBC	Neu/Lym	RBC	Protein	Glucose	Color
10	95/5	150	110	30	Near Transparent

**Table 5**

WBC	Neu/Lym	RBC	Protein	Glucose	Color
5	95/5	130	85	35	Clear Colorless

**Table 6**

WBC	Neu/Lym	RBC	Protein	Glucose	Color
0		3	75	40	Clear Colorless

**Five Ozone sessions at each other day manner were done before the complete cure from meningitis:** A Ventriculo-Peritoneal shunt was placed and last time the parents were referred after 1 year from the operation with good child neurological status and working shunt device.

There was notable development of partial epilepsy after surgery but maybe it was related to the shunt insertion and the surgery itself.

**Case 2**

An infant Fatima Mustafa - a 3 month year old, presented with a surgically treated meinigocele 1 month ago And Presented with Hydrocephalus with bacterial meningitis

**CSF (Table 7):**

**Table 7**

WBC	Neu/Lym	RBC	Protein	Glucose	Color
270	50/50	20	320	20	Yellow turbid

We had a culture: *Klebsiella*

But there was no sensitivity to any of the antibiotics, including last generations of Cephalosporins, only Imipenem shoed a (+ one plus) sensitivity on incubation despite no treatment with antibiotics has started before.

The infant treated with Imipenem with the dosage of 25mg/kg q 6 hours intravenously and with Gentamycin 10mg and Amikacin 30mg intrathecally daily.

After 2 weeks of previous intravenous and intrathecal treatment with previous antibiotics we did CSF analysis (Table 8):

Table 8

WBC	Neu/Lym	RBC	Protein	Glucose	Color
210	90/10	10	300	25	Yellow turbid

Treatment with Ozone gas has started at the beginning of the third week after doing the same ethical warning with the parents and after the stable state of meningitis for about 2 weeks confirmed by CSF analysis.

Ozone gas was diluted with CSF and was injected in solution shape with CSF each every day, with started dose of 20 µg/ml of Ozone with pure Oxygen then with 40 µg/ml.

After the 5<sup>th</sup> session CSF was as following (Table 9):

Table 9

WBC	Neu/Lym	RBC	Protein	Glucose	Color
8	90/10	0	70	40	Clear Colorless

After 1 week of relief we did 6<sup>th</sup> last session and CSF after that session was done (Table 10):

Table 10

WBC	Neu/Lym	RBC	Protein	Glucose	Color
0		0	60	40	Clear Colorless

### 6 sessions of Ozone gas therapy were done before full cure from meningitis

A Ventriculo-Peritoneal shunt was placed, and the patient was seen after 6 month from surgery and she was doing well.

### Results

A five to six sessions of Ozone gas therapy with dose of 40µg/ml intrathecally each other day were able to cure from resistant meningitis in 2 infants with hydrocephalus. (With serious and life-threatening infections like *Pseudomonas* and *Klebsiella*).

### Conclusion

1. Ozone gas treatment can be a promising method to treat resistant meningitis in infants with hydrocephalus, but it needs further study and support.
2. Its safety makes it preferable in my cases than placing external shunt drainage, or injecting antibiotics into the ventricles, but its 100% safety needs to be well studied on many cases.
3. It is an affordable treatment, quick, and available everywhere and can be done in the clinic.



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